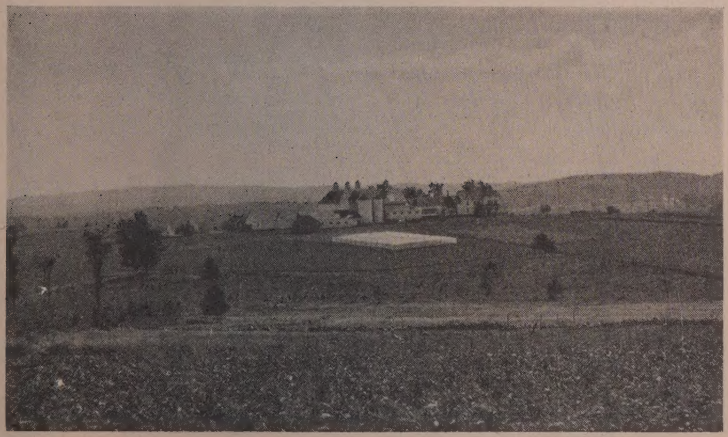
BULLETIN No. 384 JUNE, 1936

# The Maine Agricultural Experiment Station

## ORONO

## Report of Progress for Year Ending June 30, 1936



Highmoor Farm, Monmouth, Maine. A view of the farm buildings from the northeast. The experimental pasture plots are in the foreground. The aster cage for potato disease work shows up prominently in the center of the picture.

UNIVERSITY OF MAINE
THE MAINE AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE

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# AGRICULTURAL EXPERIMENT STATION
# ORONO, MAINE

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## BULLETIN 384

## INTRODUCTION

At the Station Council meeting held April 3, 1936, it was decided to change the annual Summary Report of Progress so that it would cover the period of the fiscal year instead of the calendar year. This bulletin, therefore, is intended to bring the report on the progress of the research work up to July 1, 1936, and with the exception of the Meteorological Summary and the Report on the Finances, covers only the period from January 1 to June 30, 1936.

The arrangement of the report is on the basis of subject matter, which plan was adopted beginning with the Report for 1935.

## APHID INVESTIGATIONS

APHID INVESTIGATIONS WITH SPECIAL REFERENCE TO THE RANGE OF FOOD PLANTS. Edith M. Patch. In connection with this project, a catalog of the food-plants of the aphids of the world is nearly completed.

## APPLES

A POSSIBLE MEANS OF AVOIDING ONE FORM OF WINTER INJURY TO APPLE ORCHARDS. M. T. Hilborn. Low temperature occurring during the fall and winter of 1933-1934 caused severe trunk and crotch injury on trees of many apple varieties, particularly of those that had proved nonhardy in previous severe winters. The winter of 1934-1935 caused severe trunk and crotch injury on McIntosh, a variety generally thought to be very hardy in Maine. (See Fig. 40, on left.) Such injury is characterized by the splitting and peeling away of the injured bark. The winter of 1935-1936 has produced another type of trunk injury. (See Fig. 40, on right.) This type is found mostly on bearing trees of the McIntosh and Cortland varieties. The injury is characterized by a discoloration of the bark, sometimes extending from the crown into the lower branches. The margin of the discolored area is sunken and tends to pull away slightly from the healthy bark, but there is an absence of splitting and peeling off of the bark such as was caused during

the previous two winters. In many cases the discoloration extends completely around the tree. The foliage of the affected trees varies in color from a yellow to a reddish brown.

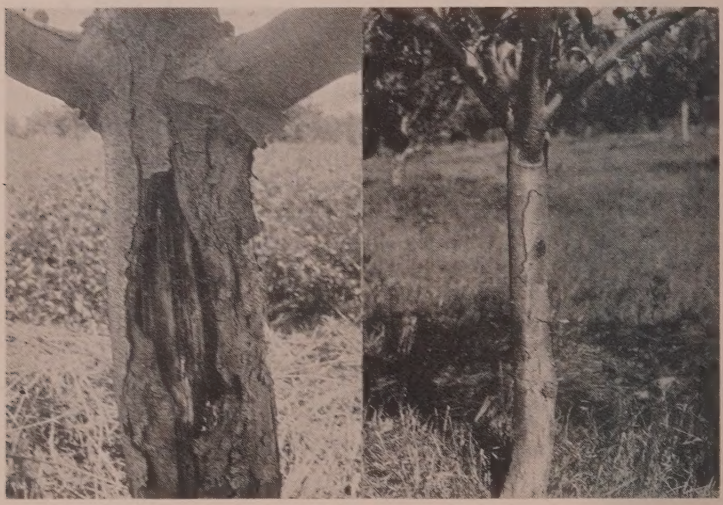

FIG. 40. McIntosh apple trees showing winter injury. On left, showing type of injury caused by the winters of 1933-1934 and 1934-1935. Note the splitting and peeling of the bark. On right, showing type of injury caused by the winter of 1935-1936, characterized by the sunken area on the right side of the trunk.

The prevalence of these injuries leads to the conclusion that the varieties of apples now produced in Maine need a hardier type of trunk upon which they may be grown. Top working and double working Maine varieties upon hardy stocks may be a solution to the problem. Several of the more promising U. S. Department of Agriculture stocks and two stocks used elsewhere for hardiness studies have been under observation at Orono. These have been subjected to artificial freezing tests with subsequent microscopic examination to determine their relative hardiness.[1] The results are given below.

[1] By the method as on p. 208, Summary Report of Progress, 1935, Me. Agr. Exp. Sta. Bul. 380. 1935.

ORDER OF DECREASING HARDINESS

1. Vermont U.S.D.A. 316
2. Hibernal
3. Vermont U.S.D.A. 317
4. Vermont U.S.D.A. 329
5. Virginia Crab
6. Spy U.S.D.A. 1283
7. Spy U.S.D.A. 1263
8. Briar Sweet x Mercier U.S.D.A. 1225
9. Spy U.S.D.A. 1256
10. Briar Sweet x Mercier U.S.D.A. 1223
11. Spy U.S.D.A. 227-2

It should be noted that these results are of one year's freezing tests only, and that these stocks should be permitted to establish themselves under Maine conditions before definite conclusions are drawn. At the present time this freezing work and other observations indicate that McIntosh has approximately the same degree of hardiness as Virginia Crab. Several of the East Malling stocks and various seedling stocks will be added to this study and the interaction of stock and scion and its effect on hardiness will be considered.

INSECTS AFFECTING THE APPLE CROP. Frank H. Lathrop. In attempting to improve the methods of pest control and to increase the economy of spray practices in Maine apple orchards it is necessary to obtain more detailed knowledge of the activities of the insects that attack apples in this State. The intention is to study the commonly injurious insects. In addition to the apple fruit fly, the study of which has been under way at this Station for a number of years, investigations are being conducted on the green apple aphid, the round-headed apple tree borer, the apple seed chalcid, the Gypsy moth, and the plum curculio.

*The Apple Fruit Fly* (*Rhagoletis pomonella* Walsh). The investigation of the apple fruit fly includes a study of the emergence of the flies, which is necessary for the proper timing of the fruit fly sprays.

Spray tests are being conducted in four orchards, which have been divided into plots to receive different spray schedules. The object is to study the effectiveness of the spray schedules in the clean-up and control of the apple fruit fly and other common insect pests. It is expected that the investigation will eventually yield increased understanding of the minimum spray schedules required for the control of insect pests in commercial orchards.

*The Apple Seed Chalcid* (*Syntomaspis druparum* Boheman). During the fall of 1935, crab apples heavily infested with seed chalcids were gathered. The infested apples remained outdoors through the winter, and in the spring of 1936, cages were placed so as to trap the adult chalcids as they emerged. A total of 653 adult chalcids were collected from the cages. Of these, 363, or 55.6 per cent, were males; and 290, or 44.4 per cent, were females.

The first adults appeared on June 13. During the next week emergence was rapid, and reached the peak on June 20. Following the peak, the rate of emergence declined throughout the rest of the emergence period. By the end of June more than 80 per cent of the adults had emerged.

The emergence records show that the seed chalcids appear during the period when the apples are small and most susceptible to attack by these insects. The first adults emerged about 13 or 14 days after petal fall, and soon after the application of the first cover spray in the surrounding orchards. The chalcids were emerging in maximum numbers about the time of the second cover spray.

*The Apple Leaf-Curling Midge* (*Dasyneura mali* Kieffer), *a New Pest in Maine Orchards.* About the middle of June apple leaves curled by the leaf-curling midge were discovered near Sanford by Ray Lovejoy, County Agricultural Agent. Mr. Lovejoy sent specimens of the injured foliage to the Experiment Station, where adult midges were reared and preserved for study. The adult midges were subsequently sent to Doctor E. P. Felt, Stamford, Connecticut, who kindly identified the species.

The apple leaf-curling midge is of European origin, and was first discovered in this country at Ipswich, Massachusetts, in 1928.[2] A careful inspection by workers of the Massachusetts Experiment Station in 1933 revealed that the pest had spread to 15 towns, comprising an area of about 1,000 square miles in northeastern Massachusetts and southeastern New Hampshire.

The pest has now entered Maine. There is a light infestation in several apple orchards in the towns of Sanford and Alfred.

The midge attacks the rapidly-growing, terminal tips of apple trees. (Fig. 41.) The edges of the tender, young leaves are tightly

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[2] Whitcomb, W. D. The Apple Leaf-Curling Midge, a New Pest of Apples, Journal of Economic Entomology, Vol. 27, pp. 355-361. 1934.

Fig. 41. The apple leaf-curling midge is a new pest in Maine apple orchards. The terminal leaves are tightly curled, and the injured tips fail to make proper growth.

curled, and the affected areas turn a distinct reddish color. The injured leaves cease growing and fail to function properly. The pest has not yet been in the State long enough to show just how severe its injury to apple trees may be under Maine conditions. It seems safe to assume, however, that although it may be injurious especially in young orchards, it is not likely to be a serious factor in apple production in this State. No satisfactory method of control has yet been discovered.

## CANNING CROPS

The Mexican Bean Beetle. John H. Hawkins. The Mexican bean beetle continues to spread in the bean growing areas of the State and has been found in several new areas during the past season. Its presence in certain localities where beans are grown for the canning factory has caused some alarm. In coöperation with growers and canners attempts have been made to stamp out local

infestations. In spite of these efforts made during previous years to eradicate small, isolated infestations and to control the spread generally, this insect steadily infests new territory each year. Observations carried on since 1932 show that the older infested areas serve as breeding places from which the beetles scatter outward. In some fields infestations are sufficiently severe to cause almost entire loss of the bean crop.

Work with insecticides for the control of the Mexican bean beetle has been continued. Magnesium arsenate is still a reliable insecticide for control of these insects. Magnesium arsenate is somewhat expensive but is less likely to cause burning and reduction in yield than when calcium arsenate is used. Except for burning of the bean plants and a consequent reduction in yield, calcium arsenate would be a cheap and effective substitute for magnesium arsenate. When used with certain carriers, extensive preliminary trials indicate that certain brands of calcium arsenate may be safely used on beans.

PEA APHID INVESTIGATIONS. John H. Hawkins. During the past few years pea aphids have caused heavy losses in certain localities in Maine. These insects are an annual threat to the pea crop of the State. During many seasons destruction of the pea crop by aphids is averted by natural checks such as fungus diseases, parasites, and the weather. There is in spite of these checks a varying amount of loss annually caused to the pea crop by aphids.

Treatments of the peas with insecticides for the control of aphids in Maine have not been entirely satisfactory. Often insecticides are not applied until late in the season, after much of the damage is already done. There appears to be some uncertainty as to the best time to apply insecticides and how they should be applied in order to obtain the most effective results.

Investigations of the biology and control of the pea aphids have been resumed. Observations have been made of fungus diseases of the aphids and also of the parasites and predaceous enemies. Observations of peas treated for control of the aphids have also been made. All the information obtained makes it evident that a thorough investigation is necessary. An investigation of the possible methods for the protection and dissemination of natural enemies of pea aphids may be of value. A study of the practicability

of insecticides and various cultural methods now in use for the control of aphids on peas is a necessary preliminary to more extensive investigations in adapting materials and methods to Maine conditions.

## CHEMISTRY INVESTIGATIONS

Work of Investigation. Elmer R. Tobey. The chemical work coöperative with members of other departments in the Station has been continued. This work includes the chemical analyses in connection with the dairy projects, the determination of the amounts of spray residues on apples and on potato foliage, the analysis of soil and fertilizer samples in connection with the problems of plant nutrition and of samples of feed used in the problems of nutrition and growth in poultry. The results of this work are included in the final published reports of the various projects.

## DAIRYING

An Economic Study of the Dairy Industry in Maine. George F. Dow. Under this general heading several studies are in progress. The work pursued in each of these studies will be discussed briefly.

*Milk Production Costs in Herds of Producer-Distributors in Maine.* The results of this study of milk production in 108 dairy herds, which produced milk for distribution in the vicinities of Portland, Waterville, and Bangor, were practically completed in manuscript form the last of June.

The cost of producing milk during the year ending April 30, 1935, was 5.5 cents per quart in the Portland area. This was about one-half cent per quart more than the cost of milk production in areas supplying milk to the Boston market. A formula was developed based on the amounts of feed and labor required to produce a given volume of milk. Using this formula with more recent prices for the year following the study, it was found that production costs had dropped about one-half cent per quart as a result of a decline in feed prices.

The average amount of grain fed was one pound of grain to

every three pounds of four per cent milk. Considerable variation in the intensity of grain feeding existed, however, between different herds. Only one per cent of the grain was home-grown.

About one third of the dairymen fed silage. The efficiency of silage feeding depended primarily on circumstances that existed on individual farms, as the average feed cost was approximately the same on farms where silage was fed as on farms where no silage was available.

An increase in milk production per cow was associated with lower per unit costs of milk production. Milk from herds of high-producing cows was produced at a cost of 3.6 cents per quart as compared with 5.8 cents in herds of low-producing cows.

Labor was utilized more efficiently with the larger herds, averaging 163 hours of man labor per cow during the year, whereas 209 hours per cow were required in the smaller herds.

*Cost of Distributing Milk in Maine.* This study includes complete information for 126 milk distributors in the areas of Portland, Waterville, and Bangor, for the year ending April 30, 1935. The data were secured at the same time as the figures on the cost of producing milk in herds of producer-distributors.

A summary of the costs of milk distribution has been completed and has been made available to the Maine Milk Control Board and to distributors who cooperated in the study. A more complete analysis of this information is being made to determine the effect of factors that influence costs.

*Dairy Farm Organization and Management Studies.* Some additional work has been done on these studies which were reported in the last Progress Report, but the analysis is not yet completed. This work will be finished as soon as possible after the completion of the studies on milk distribution.

## FARM CREDIT

FARM CREDIT IN MAINE. Charles H. Merchant. Information on farmers' credit needs was obtained during the summer of 1935 for the principal types of farming in the State. The material was obtained from farm account books in cooperation with the Extension Service. The summer of 1936 has been devoted to a study of

sources of farm credit in the more important agricultural areas of the State. This information was obtained in part from information furnished by the Production Credit Associations in Maine and in part from personal interviews with farmers.

Since the middle of March, the Maine Agricultural Experiment Station has coöperated with the Federal Bureau of Agricultural Economics on a WPA project on farm mortgages and land transfers. Information for this project was obtained from farm mortgage records in the County Deeds office in six of the sixteen counties of the State. The data included names of parties connected with the farm mortgage, date of the mortgage, amount of the consideration, date of maturity, interest rate, method of payment, extension of maturity date of mortgage, date of release of the mortgage, date of foreclosure of the mortgage, and certain other information concerning either the mortgage or the mortgaged property. The Bureau of Agricultural Economics desires to secure such information on farm mortgages from 1917 to date. The counties where the study is being conducted are Androscoggin, Aroostook, Penobscot, Waldo, Washington, and York.

The general supervision of this project is with the Experiment Station. The Bureau of Agricultural Economics provided area and regional supervisors whose duty is to check the work in the field. This material will be tabulated and summarized by the Bureau of Agricultural Economics and much valuable information should be forthcoming. From examining these records in the various county offices, two outstanding situations were found to exist. First, many of the farm mortgages are for a short period of time; some are demand mortgages, many others are for one year, and only a few mortgages are for a period of ten or more years. The second important observation is that interest rates are frequently seven, eight, and occasionally nine per cent and higher.

Nearly all the general information concerning credit conditions in Maine has been collected and analyzed. The next phase of the study will be a more detailed study of credit conditions in Aroostook County.

## FOODS AND NUTRITION

A Study of the Food Habits and the Nutritional Status of Children in Selected Communities in Maine. Mary M.

Clayton. Since December, 1935, complete summaries have been made of the data secured in the survey (made in the fall of 1934 and spring of 1935) of the nutritional status of grade-school children in three selected towns in the State. Some of the most outstanding results are here reported.

*Physical Examinations.* The physical examinations showed some noticeable differences in the children from each of the three towns. Moreover, these differences appear to be closely related to differences in diet. Results secured for the three towns were enough alike, however, so that average figures can be given. The following are some of the most significant:

In the fall 12.7 per cent of the children were 10 per cent or more underweight for height and age. In the spring the number increased to 14 per cent. In all three towns there were more underweight girls than boys. Fifty seven and eight tenths per cent of the children were under average height for their age. However, the average heights of all the children were found to be only 1.2 per cent below the averages for 30,000 children in various parts of the United States.

Only 2.9 per cent of the children showed definite evidence of lowered capillary strength in the fall but the number increased to 5.7 per cent in the spring. The capillary strength test has been used elsewhere for detecting vitamin C deficiency but other factors may affect the results of the test.

Thirty one per cent of the children showed enlarged tonsils.

It was difficult to determine from the physical examinations just how many children had rickets in infancy. However, 13 per cent showed bony defects which indicated that they very probably had the disease. The number of children who showed these defects was much lower in one town than in the other two.

The most outstanding defect noted was dental caries. In the fall the average number of cavities per mouth was 12 and there was only one child with no cavities. In the spring the number had increased to 15.7. The average number of fillings per mouth was only 0.79.

*Diet Survey.* The data secured in the diet survey included information regarding the prenatal history of the children and their diets during infancy, preschool, and school years. Also, menus

were secured for the meals which the children had eaten the day before.

As far as could be determined from questioning the mothers only 21.8 per cent of them had received adequate diets before the children were born. The chief deficiencies were the result of failure to use adequate amounts of milk and some source of vitamin D.

A little less than half of the children were breast fed for at least five months and an average of 5.4 per cent were weaned from the breast after the twelfth month. The following table gives the percentage of children who received the various dietary supplements during their first year:

| | Per cent |
|---|---|
| Orange juice | 59.5 |
| Tomato juice | 15.4 |
| Cod-liver oil | 21.5 |
| Egg | 53.5 |
| Vegetables | 52.3 |
| Cereals | 77.1 |

Accurate data regarding diets during preschool years were difficult to secure. It was possible, however, for most of the mothers to estimate the amount of milk that the children had. The average for the children of all three towns was 2.7 cups per day. Cod-liver oil was used very irregularly in all three towns during the winter months.

The menus for the meals which the children had eaten the day before the home visit showed that the suppers were often especially inadequate for the children who had eaten their lunches at school. They also indicated that less than half of the children had fruit of any kind and only about one-fourth had fresh or both fresh and cooked fruit. The consumption of citrus fruit was very small. The number of vegetables used, exclusive of potatoes, varied considerably in the three towns. Even in the town which showed the highest consumption only about one-fourth of the children had two or more cooked vegetables besides baked beans and potatoes. Pickles were widely used in all three towns. Only 13.1 per cent had either tomatoes or a raw vegetable.

Meat or fish was used very generally, depending on the locality. Eggs, however, were used very sparingly.

The amount of milk drunk per child per day ranged between 1.7 and 2.4 cups in the different towns.

The amount of cookies, cake, and doughnuts consumed was very high in proportion to the amount of other foods served. The most common dietary faults could be stated to be the consumption of too many of the latter foods together with the use of too little milk and too few fruits, vegetables, and whole grain cereals. Such a diet tends to be low in minerals and vitamins.

Although economic conditions are no doubt partly responsible for many of the observed dietary deficiencies, most of these could be corrected by the increased use of milk and milk products, eggs, whole grain cereals, and fruits and vegetables which could be produced at home. A variety of vegetables should be used during the winter as well as the summer months and families should attempt to have a sufficient supply available. It has been shown that tomatoes can be raised successfully even in the northern part of the State and the use of more of these and cabbage is especially recommended. Raw vegetables should be served daily.

In one community where the survey was continued during 1935 and 1936, an attempt was made to bring about an improvement in the condition of the children by encouraging the mothers to cooperate in improving their diets. Physical examinations were made in the fall and spring but there did not appear to be much change in the children from the previous year. The number who were 10 per cent or more underweight for height and age was, however, somewhat lower. The spring examinations might have shown a greater improvement in the children had it not been for a severe epidemic of influenza.

Diet records kept for one week by the children at school showed deficiencies similar to those indicated in the 1934-1935 studies.

THE ANTISCORBUTIC VALUE OF HOME CANNED PICKLES OF VARIOUS TYPES USED IN MAINE. Mary M. Clayton. Thirteen samples of mixed pickles and relishes made by Maine housewives and three made in the laboratory were tested for their vitamin C content by a chemical titration method. Results showed that the samples made by housewives varied from 2.73 to 6.91 mg. of vitamin C per 100 gms. of pickle. A sample of sweet mixed pickle made in the laboratory contained only 2 mg. per 100 gms. Another

type of pickle made from fresh green peppers and raw cabbage gave the high figure of 38.9 mg. per 100 gms.

Preliminary experiments using pure ascorbic acid, brine, and vinegar showed that brine has no destructive effect on vitamin C, but that in the presence of air, vinegar hastens the oxidation of the vitamin. In pickle making by the quick process where the vegetables are first soaked in brine and then covered with hot vinegar and stored in sealed jars the chief loss of vitamin C results from the solution of the vitamin in the brine and vinegar.

Analysis of the sweet mixed pickle, made in the laboratory, by the biological method for vitamin C gave results which agreed with those secured by the chemical method.

## GARDEN CROPS

Rutabagas. Frederick B. Chandler, Joseph A. Chucka, and Irvin C. Mason. Rutabagas were grown in soil and in nutrient solutions both with and without added boron under greenhouse conditions. The plants grown in the nutrient solution without boron soon showed boron deficiency and practically stopped growing while those receiving boron made normal growth. When the plants showing boron deficiency symptoms were transferred to nutrient solutions containing boron they resumed growth and developed normal leaves.

This experiment indicated that rutabagas require more boron for normal growth than is found in some of the Maine soils. If boron is used in the fertilization of rutabagas, it should be thoroughly mixed with the fertilizer and spread evenly in the row and covered with soil before the seed is planted. The rate of application should not exceed ten pounds of borax per acre.

Control of the Striped Cucumber Beetle, *Diabrotica vittata* Fabricus. John H. Hawkins. The striped cucumber beetle causes some loss to cucumbers every year. The loss is severe during certain years unless effective control measures are used. There seems to be some uncertainty about what is the best substance to be used as a carrier for insecticidal dusts used in control of the striped cucumber beetle. Work done during previous years has shown that lime, when used alone or with arsenates, causes burning of the cu-

cumber foliage. Plans are made for using other substances to replace lime as a carrier and also to combine lime with copper sulphate as a carrier for calcium arsenate. A planting of 340 hills of cucumbers has been made and plans for five different treatments of 10 replications each have been made in order to observe the effects of the insecticides upon the foliage and upon the yield of cucumbers.

## GRASSLAND MANAGEMENT

PASTURE MANAGEMENT. D. S. Fink. One of the principal aims of the dairyman today is to develop a workable and profitable pasture scheme whereby a much larger percentage of his summer feed will be "cow harvested." With this end in view an attempt is being made to gain such information as is needed in developing a sound pasture program.

All of the pasture and hayland work by the Experiment Station is very new and much of it is just under way. For example, at Highmoor Farm this coming season we will be grazing seven differently fertilized permanent pasture paddocks in addition to a paddock each of Kent wild white clover, Ladino clover, oats seeded down, sudan grass, and hay aftermath.

It is recognized that a complete pasture scheme must include several crops. It is further recognized that there is a definite need for better pasture plants and to this end considerable attention is being directed. Finally, the real need facing the dairy farmer today, that of improving the fertility of his land devoted to pasture, is being given immediate attention.

In Table 1 can be seen what may be expected from an initial treatment of the various fertilizer elements on average Maine permanent pastures, together with the carry-over of these treatments throughout a second season. These data show clearly that the permanent pasture land in Maine, today, does not have the inherent capacity to furnish the necessary amounts of any of the major plant food elements for reasonable production.

The need for a complete fertilizer as the initial step in pasture improvement is clearly indicated. It is particularly evident that the soils are as deficient of potash as they are of phosphates, if not more so. This was clearly shown in the series receiving only the

mineral elements. Here the addition of potash to phosphoric acid and limestone (Plots 12 and 10) actually brought in and encouraged the growth of white clover very markedly. Potash meant the difference between practically no change and that of considerable improvement very striking to the eye. The response of grass (Plots 7 and 6) to the addition of potash, on the other hand, was hardly noticeable to the eye, yet the increase in yield obtained was almost as large as in the above comparison of Plots 12 and 10.

TABLE 1

*First and Second Year Response from Variously Fertilized Pasture Test Plots on Four Different Soil Types, Showing Yields in Absolute Dry Matter per Acre Together with Increases in Yield Due to the Several Elements*

| | | 1935 | | | | 1936 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Plot No. | | Treatment | Pounds dry matter an acre | Increase | Added treatment | Treatment | Pounds dry matter an acre | Increase | Added treatment |
| 1 | Increasing amount of white clover ↓ | None | 1450 | 46 | PL | None | 1274 | 86 | PL |
| 10 | | –P–L | 1496 | 444 | K | None | 1360 | 466 | K |
| 12 | | –PKL | 1940 | 704 | N | None | 1826 | 756 | N |
| 7 | ↑ Increasing amount of grass | NPKL | 2644 | 42 | L | N___ | 2582 | 144 | L |
| 9 | | NPK– | 2602 | 340 | K | N___ | 2438 | 346 | K |
| 6 | | NP–L | 2304 | 308 | PL | N___ | 2236 | 262 | PL |
| 4 | | N___ | 1996 | 546 | N | N___ | 1974 | 700 | N |
| 1 | | None | 1450 | | | None | 1274 | | |

Note: Amounts of fertilizer applied per acre N = 60 lbs. of nitrogen; P = 60 lbs. of phosphoric acid; K = 60 lbs. of potash; L = one ton of limestone.

These data further indicate that limestone is not especially needed in the improvement of permanent pastures.

Finally the fact is shown that nitrogen in our pasture land is the most deficient of all the major plant food elements.

Table 2 shows the extent to which a lack of available nitrogen is holding down the productivity of timothy meadows. Plots receiving sixty pounds of nitrogen per acre, produced in this experiment, 1,742 pounds more hay per acre than the unfertilized plots. This experiment was conducted on some rather poor timothy mea-

A. Limestone and Superphosphate.

B. Limestone, Superphosphate, and Muriate of Potash.

FIG. 42. Photographs showing the need for potash on one of the major soil types in the dairy region of Maine. This response was obtained in the greenhouse under controlled conditions of temperature and moisture, and even under these ideal conditions limestone and superphosphate proved ineffective as a pasture improvement treatment. Equally as definite a response was obtained in the greenhouse from the addition of potash on the other soil types for which field data have been reported.

dows. The practice of fertilizing timothy meadows is adapted to any pasture scheme in Maine for two reasons. First, because the practice can release a few acres of crop land upon which to build a good pasture of one type or another. Secondly, given a reasonable amount of midsummer rainfall a quicker and more luxuriant aftermath results which can always be used for pasture.

TABLE 2

*Response from Nitrogen, Phosphoric Acid, and Potash on Some Rather Poor Timothy Meadows*

| Treatment | Yield in hay per acre (12% moisture) | Increase yield due to added treatment |
|---|---|---|
| NPK | 3428 | |
| | | ) 96 |
| NP | 3332 | |
| | | ) 211 |
| N | 3111 | |
| | | ) 1244 |
| None | 1867 | |
| | | ) 1742 |
| 2N | 3609 | |
| | | ) 353 |
| 2N, P | 3962 | |
| | | ) 458 |
| 2N, P, K | 4420 | |

Note: Amounts of fertilizer applied per acre N = 30 lbs. of nitrogen; 2N = 60 lbs. of nitrogen; P = 30 lbs. of phosphoric acid; K = 30 lbs. of potash.

## INSPECTION SERVICE

WORK OF INSPECTION SERVICE. Elmer R. Tobey, C. Harry White, Bernie E. Plummer, Jr., Glenn H. Perkins, Millard G. Moore, and George P. Steinbauer. The time of the members of the Inspection Service is occupied in making the analyses of official samples collected in the enforcement of the regulatory laws pertaining to the manufacture or sale of foods and drugs, feeding stuffs, fertilizers, fungicides and insecticides, agricultural seeds, gasoline and motor lubricants. A brief summary of the results of the work of inspection from January 1 to July 1, 1936, is given in this report.

*Food and Drug Inspection.* One hundred forty-seven samples of foods, including Hamburg steak, ice cream, maple products, molasses, oil used in packing sardines, and sausage, and ninety-two

samples of drugs, including barbital, headache remedies, diluted hydrochloric acid, soda mint tablets, and sweet spirit of nitre have been examined. The results of the analyses are reported in Official Inspections 159.

*Feeding Stuffs Inspection.* Nine hundred fifty-nine samples of feeding stuffs were received and the percentages of protein, fat, and fiber in these samples were determined. The results of the analyses are published in Official Inspections 160.

*Testing of Dairy Glassware.* It is required by law that all Babcock glassware used in Maine by creameries, ice cream factories, or others buying or selling milk or cream on a basis of the butterfat content must be tested for accuracy at the Maine Agricultural Experiment Station. Eight hundred thirty-five pieces have been examined and, with the exception of two pieces, all were passed.

*Gasoline Inspection.* Forty-seven samples of gasoline were received. The results of the analyses indicate that five of these samples were found to require a higher temperature for complete distillation than the maximum temperature (437° F.) specified in the law regulating the sale of motor gasoline.

*Motor Lubricants Inspection.* Eleven of the sixty-three samples of motor oils which were examined failed to meet the specifications for the respective brands asked for by the inspector. In practically every instance it appeared to be a case of substitution by the salesman.

## KEROSENE COOK STOVES

THE ECONOMICAL MANAGEMENT OF KEROSENE COOK STOVES TO SECURE PALATABILITY OF PRODUCT IN MAINE FARM HOUSEHOLDS. Merna M. Monroe and Pearl S. Greene. Preliminary investigations have been made on five kerosene stoves. These five stoves represent three types of burners: two of the stoves are equipped with long-chimney burners, which have wicks; two other stoves have the short-chimney burners, with wicks; and one stove has the wickless, short-chimney burner, with an asbestos lighting ring. Four of the stoves have built-in ovens. Two of the ovens have rock-wool insulation, another has one layer of asbestos paper for insulation, and the other has no insulation.

The spacing of the burners for top-of-the-stove cooking determines the maximum diameter of two or more utensils which can be used at the same time. Two of the stoves will accommodate the use of two utensils having a maximum top or bottom diameter of 10½ inches; with another stove, the widest utensils which can be used at the same time are those not over 9½ inches in diameter; and with the other two stoves, pans not over 9 inches wide may be placed squarely upon two or more adjacent burners.

Tests designed to ascertain the amount of water evaporated during maintenance of boiling on high and on low heat indicate that there is room for considerable improvement in the design of these burners. The chief difficulty is that of inability to obtain a low rate of evaporation with the burner set at "low heat."

There are two objections to burners which cannot be regulated to restrict the rate of heat to that needed for maintenance of boiling. The first objection is that of unnecessary waste of heat, which is dissipated through the rapid rate of evaporation during maintenance of boiling. The rapid rate of evaporation during a cooking process necessitates the initial heating of a large quantity of water in order to provide a means of heat loss without drying and burning the food. Although this waste of heat may not greatly increase actual cooking costs, the waste is undesirable during summer use because it overheats the kitchen.

A second objection to burners which cannot be regulated to provide a wide range of rates of heat input is based upon the nutritional point of view. If the burners cannot be regulated to give a low heat input during boiling, the housewife finds it necessary to use a large quantity of water in boiling processes. A large quantity of water is likely to cover more exposed surface of the food than does a small amount; the more food surface exposed to the water, the greater the loss of minerals and water-soluble vitamins through solution in the water.

To facilitate meal preparation, stoves should be designed to meet the requirements of all cooking processes. Thus, for top-of-the-stove cooking, most processes specify quick heating to obtain the cooking temperature, and then the reduction of heat input to that needed to maintain the cooking temperature.

## LAND USE

LOCAL MARKET AREA STUDY WITH EMPHASIS PLACED ON LAND UTILIZATION. Charles H. Merchant and Andrew E. Watson. A land utilization study is partially completed for five towns in Cumberland County. The towns included in the study are Baldwin, Gray, New Gloucester, Standish, and Windham.

From a detailed survey of all farm buildings in the five towns, the farms were divided into six groups. These groups were excellent, good, poor, abandoned, with buildings gone, and used only as residences. On this basis 8 per cent of the farms were classed as excellent, 19 per cent as good, 30 per cent as poor, 21 per cent with buildings gone, 8 per cent abandoned, and 14 per cent used only as residences.

Over fifty per cent of the farms were located on dirt roads. The importance of good roads to agriculture was emphasized by the fact that 77 per cent of the best farms were on improved highways which constituted only 32 per cent of the total road mileage within the towns.

Nearly 60 per cent of all the farms were located on land with a one to five per cent slope. As the steepness of the slope increased, the land was used less intensively.

Over 93 per cent of the better farms used electricity and telephones, as contrasted with only 55 per cent of the poorer farms.

A detailed cover map showed that 81 per cent of the total land area in the five towns was in woods. Of the remaining 19 per cent, 9 per cent was in pasture, and 10 per cent was used to grow cultivated crops including hay.

The land was divided into six classes based on the present and probable future use of the land. In making this classification the size and condition of buildings, character of the soil, and the use of the land were the more important factors considered. The land classes were as follows: Class I included all permanent forest land, swamps, and marshes. Class II consisted of land now in farms but in the state of rapid decline, which might be considered submarginal from an agricultural viewpoint. Class III included land used for agricultural purposes but rather poor in quality. This land was more intensively used than land in Class II but has many physical and economic disadvantages for farming. Class IV rep-

resented land which probably will remain permanently in agriculture as both physical and economic factors seem favorable. Class V comprised land which was the most intensively used and best adapted for agricultural purposes. Class VI included all land used for urban or suburban purposes.

Of the total acreage in the area studied, 78 per cent was in Class I, 5 per cent in Class II, 11 per cent in Class III, 5 per cent in Class IV, no land in Class V, and less than 1 per cent in Class VI.

The information that such a study provides should be helpful in planning for the most efficient future uses of the land resources in the area. It is the hope that this study is the beginning of a much larger project including the principal agricultural areas of the State.

The tabulations of the purchases of agricultural products by retail stores, hotels, and camps in York County for 1931 and 1932 have been completed. This information should be of considerable value to the proposed larger project dealing with land utilization.

## POTATOES

An Economic Study of the Potato Industry in Maine. William E. Schrumpf. Nearing completion under this heading is a study of the costs and returns in producing potatoes in Maine. A study of motive power on Maine potato farms is well under way and material for a study comparing the farm organization of potato farms in 1935 with that of 1930 will be obtained during the summer of 1936.

Costs of Producing Potatoes on Aroostook County Farms. Tentative average costs per acre and per barrel of potatoes produced in three groups of Aroostook County farms have been computed for the three crop years, 1928, 1929, and 1930. These groups represent (1) farms in the Presque Isle area which produced table-stock potatoes, (2) farms in the Houlton area which also produced table-stock potatoes, and (3) Aroostook County farms which produced certified-seed potatoes. The farms producing table-stock potatoes in the Presque Isle area will hereinafter be termed Presque Isle farms; those producing table-stock potatoes in the Houlton area, Houlton farms; and those producing certified-seed potatoes, certified-seed farms.

The combined cost per acre of growing, harvesting, storing, and selling potatoes averaged higher over the three-year period on the certified-seed farms than on the farms of either the Presque Isle or the Houlton group. The total cost of the above four operations was $209 per acre on the certified-seed farms, $171 per acre on the Presque Isle farms, and $165 per acre on the Houlton farms. The cost per barrel of potatoes produced was also highest ($1.64) on the certified-seed farms. Although as noted, the production cost per acre of potatoes produced was smaller on the Houlton farms than on the Presque Isle farms, the cost per barrel was larger on the Houlton farms ($1.56) than on the Presque Isle farms ($1.47).

The largest proportion of the total cost in each of the groups was incurred in growing the crop. On the Houlton farms this proportion was 66.6 per cent, on the Presque Isle farms 62.8 per cent, and on the certified-seed farms 59.3 per cent. The harvesting cost was 11.0 per cent of the total cost on the Houlton farms, 10.9 per cent on the Presque Isle farms, and 9.5 per cent on the certified-seed farms. The cost of storing the potatoes on the certified-seed farms was 20.9 per cent of the total production cost, on the Presque Isle farms 19.3 per cent, and on the Houlton farms 15.1 per cent. The proportion of the total cost that was for selling the crop was largest, 10.3 per cent, on the certified-seed farms. The cost of selling amounted to 7.0 per cent of the total on the Presque Isle farms and 7.3 per cent on the Houlton farms. In Table 3 is given the cost per acre of growing, harvesting, storing, and selling potatoes for each of the three groups.

TABLE 3

*Cost Per Acre of Growing, Harvesting, Storing, and Selling Potatoes for Three Groups of Potato Farms in Aroostook County, Maine Average 1928, 1929, and 1930*

| Item | Presque Isle Farms | Houlton Farms | Certified-seed Farms | Presque Isle Farms | Houlton Farms | Certified-seed Farms |
|---|---|---|---|---|---|---|
| | dollars | dollars | dollars | per cent | per cent | per cent |
| Growing | 107.35 | 109.68 | 123.77 | 62.8 | 66.6 | 59.3 |
| Harvesting | 18.57 | 18.12 | 19.92 | 10.9 | 11.0 | 9.5 |
| Storing | 33.04 | 24.98 | 43.80 | 19.3 | 15.1 | 20.9 |
| Selling | 11.98 | 11.99 | 21.63 | 7.0 | 7.3 | 10.3 |
| Total | 170.94 | 164.77 | 209.12 | 100.0 | 100.0 | 100.0 |

## TABLE 4

*Costs of Growing Potatoes for Three Groups of Potato Farms in Aroostook County, Maine. Average 1928, 1929, and 1930*

| Item | Average per Acre | | | | | | Per cent of Total Cost | | |
|---|---|---|---|---|---|---|---|---|---|
| | Presque Isle Farms | | Houlton Farms | | Certified-seed Farms | | Presque Isle Farms | Houlton Farms | Certified-seed Farms |
| | Amount | Cost | Amount | Cost | Amount | Cost | | | |
| Man labor | 37.8 hr. | $ 14.48 | 45.4 hr. | $ 16.17 | 44.7 hr. | $ 17.56 | 13.5 | 14.7 | 14.2 |
| Horse labor | 46.9 hr. | 11.87 | 60.2 hr. | 14.15 | 48.2 hr. | 10.88 | 11.0 | 12.9 | 8.8 |
| Tractor use | 2.0 hr. | 2.93 | 1.7 hr. | 2.26 | 2.4 hr. | 3.07 | 2.7 | 2.1 | 2.5 |
| Truck use | 0.4 hr. | 0.48 | 0.6 hr. | 0.42 | 0.4 hr. | 0.43 | 0.5 | 0.4 | 0.3 |
| Automobile use | | 0.95 | | 0.96 | | 0.99 | 0.9 | 0.9 | 0.8 |
| Equipment use | | 4.00 | | 4.21 | | 4.38 | 3.7 | 3.8 | 3.5 |
| Total labor, etc. | | $ 34.71 | | $ 38.17 | | $ 37.31 | 32.3 | 34.8 | 30.1 |
| Seed | 6.5 bbl. | $ 16.01 | 6.3 bbl. | $ 14.89 | 7.6 bbl. | $ 25.32 | 14.9 | 13.6 | 20.5 |
| Seed treatment material | | 0.17 | | 0.04 | | 0.56 | 0.2 | 0.1 | 0.5 |
| Seed certification | | | | | | 0.58 | | | 0.5 |
| Fertilizer | 0.94 T | 40.13 | 0.99 T | 41.17 | 0.94 T | 39.93 | 37.4 | 37.5 | 32.3 |
| Barnyard manure | 1.02 T | 3.04 | 1.56 T | 4.53 | 1.46 T | 4.52 | 2.8 | 4.1 | 3.6 |
| Green manure crops | 0.04 A | 0.22 | 0.05 A | 0.27 | 0.11 A | 0.63 | 0.2 | 0.3 | 0.5 |
| Spray and dust | 5.0 Ap. | 3.71 | 4.4 Ap. | 3.99 | 5.6 Ap. | 3.89 | 3.5 | 3.6 | 3.1 |
| Land use | | 7.93 | | 5.25 | | 9.36 | 7.4 | 4.8 | 7.6 |
| Interest on growing costs | | 1.00 | | 1.00 | | 1.16 | 0.9 | 0.9 | 0.9 |
| Other costs | | 0.43 | | 0.37 | | 0.51 | 0.4 | 0.3 | 0.4 |
| Total seed, etc. | | $ 72.64 | | $ 71.51 | | $ 86.46 | 67.7 | 65.2 | 69.9 |
| Total growing costs | | $107.35 | | $109.68 | | $123.77 | 100.0 | 100.0 | 100.0 |
| Acres of potatoes per farm | 43 A | | 30 A | | 52 A | | | | |
| Yield per acre | 116.8 bbl. | | 106.3 bbl. | | 127.5 bbl. | | | | |
| Cost per barrel | | 92 cents | | 103 cents | | 97 cents | | | |

*Cost of Growing Potatoes.* The growing cost includes the various items up to but not including digging. The labor, power, and equipment cost includes man labor, horse labor, and the use of tractors, trucks, automobiles, and the farm equipment employed on potatoes. The other items of cost are seed, seed treatment material, certification, fertilizer, barnyard manure, green manure crops, spray and dust, land use, interest, and miscellaneous.

The cost per acre of growing potatoes up to the time of harvesting was highest on the certified-seed farms, $124, compared with $110 on the Houlton farms and $107 on the Presque Isle farms. The growing cost per barrel of potatoes produced, however, was highest on the Houlton farms because of the relatively low yield rate in this group. On the Houlton farms the growing cost was $1.03 per barrel, on the certified-seed farms 97 cents per barrel, and on the Presque Isle farms 92 cents per barrel (Table 4).

The cost of commercial fertilizer was the most important single item of the growing cost and accounted for 37.5 per cent of the total on the Houlton farms, 37.4 per cent on the Presque Isle farms, and 32.3 per cent on the certified-seed farms. The cost of man labor was 14.7 per cent of the growing cost on the Houlton farms, 14.2 per cent on the certified-seed farms, and 13.5 per cent on the Presque Isle farms. The cost of horse labor made up 12.9 per cent of the total on the Houlton farms, 11.0 per cent on the Presque Isle farms, and 8.8 per cent on the certified-seed farms. The cost of all labor, power, and equipment was 34.8 per cent of the growing cost on the Houlton farms, 32.3 per cent on the Presque Isle farms, and 30.1 per cent on the certified-seed farms. The seed cost was 20.5 per cent of the total on the certified-seed farms, 14.9 per cent on the Presque Isle farms, and 13.6 per cent on the Houlton farms.

*Man labor.* The amount of man labor expended per acre in growing potatoes was largest on the Houlton farms, the certified-seed and Presque Isle farms ranking second and third respectively. The man labor per acre averaged 45.4 hours on the Houlton farms, 44.7 hours on the certified-seed farms, and 37.8 hours on the Presque Isle farms. The cost per acre for man labor, however, was slightly more on the certified-seed farms than on the Houlton farms because of a higher rate per hour. The per-acre cost of man labor was $17.56 on the certified-seed farms, $16.17 on the Houlton farms, and $14.48 on the Presque Isle farms.

*Horse labor.* The cost for horse labor included feed, veterinary service, care, shoes, shelter, taxes, and depreciation in the horse inventory. The value of manure produced and appreciation in the horse inventory were deducted to obtain the net cost. The proportional share on potatoes was charged to the potato enterprise.

The amount of horse labor in growing an acre of potatoes was largest on the Houlton farms (60.2 hours), next largest (48.2 hours) on the certified-seed farms, and smallest (46.9 hours) on the Presque Isle farms. The cost of horse labor on the Houlton farms was $14.15 per acre, on the Presque Isle farms $11.87, and on the certified-seed farms $10.88.

*Tractor work.* The cost for tractor includes gas, oil, care, shelter, repairs, and depreciation. The potato enterprise was charged with its share of this cost on the basis of the proportionate amount of use on potatoes.

More tractor work per acre of potates grown was expended on the certified-seed farms than on the farms of either of the other two groups. Tractor work on these farms amounted to 2.4 hours per acre compared with 2.0 hours on the Presque Isle farms and 1.7 hours on the Houlton farms. On the certified-seed farms the cost of tractor work per acre was $3.07, on the Presque Isle farms $2.93, and on the Houlton farms $2.26.

*Truck work.* Trucks were used relatively little in growing potatoes. The total work of trucks in growing an acre of potatoes averaged 0.6 hour on the Houlton farms and 0.4 hour on the farms of each of the other two groups. The cost of the truck work per acre on the Houlton farms was 42 cents, on the certified-seed farms 43 cents, and on the Presque Isle farms 48 cents.

*Seed.* The cost of the seed potatoes planted per acre was largest on the certified-seed farms. On these farms more seed was planted per acre and the price per barrel was higher than on the farms of the other two groups. The cost of seed on the certified-seed farms was $25.32 per acre compared with $16.01 per acre on the Presque Isle farms and $14.89 per acre on the Houlton farms. The seed planted per acre averaged 7.6 barrels on the certified-seed farms, 6.8 barrels on the Houlton farms, and 6.5 barrels on the Presque Isle farms. Seed cost $3.33 per barrel on the certified-seed farms, $2.46 per barrel on the Presque Isle farms, and $2.19 per barrel on the Houlton farms.

*Seed treatment material.* On the certified-seed farms about three-fourths of the seed was treated prior to planting for the control of disease. On the Presque Isle farms approximately one-fifth of the seed was treated and on the Houlton farms less than one-tenth. The cost of the material used in the treatment of seed in 1930 was $1.51, $1.25, and $1.23 per acre treated on the certified-seed farms, the Presque Isle farms, and the Houlton farms respectively. The average cost of seed treatment material per acre planted was 56 cents, 17 cents, and 4 cents respectively.

*Fertilizer.* There was not much variation between the three groups of farms in the amount or cost of fertilizer applied to an acre of potatoes. On the Houlton farms 0.99 ton costing $41.17 was applied per acre, on the Presque Isle farms 0.94 ton costing $40.13, and on the certified-seed farms 0.94 ton costing $39.93.

Fertilizer of the 5-8-7 formula[3] was the kind in most general use on the farms of the three groups. In the Houlton group 5-8-7 fertilizer, including double strength (10-16-14), was used on 75.0 per cent of the potato acreage, in the certified-seed group on 52.8 per cent, and in the Presque Isle group on 46.9 per cent.

The fertilizer of next importance in respect to acreage on the Presque Isle farms was that having the 6-9.5-8.5 formula. On the Houlton and certified-seed farms fertilizer of the 5-7-10 formula was of second importance. The 6-9.5-8.5 fertilizer accounted for 20.3 per cent of the potato acreage fertilized on the Presque Isle farms, and the 5-7-10 fertilizer 18.5 per cent and 13.4 per cent on the Houlton and certified-seed farms respectively. The 6-8-12 and 9-11-10 fertilizers were applied on 9 to 10 per cent of the acreage of the Presque Isle and certified-seed farms but on less than one per cent of the Houlton farms.

Although fertilizers of eight other formulas were used they were relatively unimportant. The potato acreages fertilized with fertilizers of the various formulas are shown for the three groups of farms in Table 5.

An average of 429 pounds of plant food (nitrogen, phosphoric acid, and potash combined) was applied per acre to potatoes on the certified-seed farms, 428 pounds on the Presque Isle farms, and 421

[3] This formula is 5 per cent ammonia ($NH_3$), 8 per cent phosphoric acid ($P_2O_5$), and 7 per cent potash ($K_2O$).

TABLE 5

*Potato Acreage Fertilized with Fertilizers of Various Formulas for Three Groups of Potato Farms in Aroostook County, Maine Average 1928, 1929, and 1930*

| Formula | Number of Acres | | | Per cent of Total Acres | | |
|---|---|---|---|---|---|---|
| | Presque Isle Farms | Houlton Farms | Certified-seed Farms | Presque Isle Farms | Houlton Farms | Certified-seed Farms |
| 5-8-7 | 1581 | 821 | 421 | 36.3 | 62.8 | 38.6 |
| 5-7-10 | 351 | 242 | 146 | 8.1 | 18.5 | 13.4 |
| 10-16-14 | 461 | 159 | 155 | 10.6 | 12.2 | 14.2 |
| 6-9.5-8.5 | 885 | 71 | 119 | 20.3 | 5.4 | 10.9 |
| 6-8-12 | 440 | — | 106 | 10.1 | — | 9.7 |
| 9-11-10 | 407 | 8 | 106 | 9.3 | 0.6 | 9.7 |
| 8-13-11 | 167 | — | — | 3.8 | — | — |
| 6-9-10 | — | — | 25 | — | — | 2.3 |
| 4-6-10 | 23 | 7 | — | 0.5 | 0.5 | — |
| 6-9.5-12 | 14 | — | 7 | 0.3 | — | 0.6 |
| 10-16-20 | 15 | — | 2 | 0.4 | — | 0.2 |
| 7-8-10 | 7 | — | 4 | 0.2 | — | 0.4 |
| 5-11-13 | 3 | — | — | 0.1 | — | — |
| 12-19-17 | 1 | — | — | * | — | — |
| Total | 4355 | 1308 | 1091 | 100.0 | 100.0 | 100.0 |

* Less than 0.05 per cent.

pounds on the Houlton farms. The proportion of nitrogen was very similar in each group. About 21 per cent of the plant food was nitrogen. However, as between phosphoric acid and potash, the largest proportion of the plant food was phosphoric acid in the Presque Isle and Houlton groups while in the certified-seed group the largest proportion was potash.

The cost per unit of 100 pounds of this plant food was highest ($9.78) on the Houlton farms, next highest ($9.38) on the Presque Isle farms, and lowest ($9.31) on the certified-seed farms (Table 6). A larger proportion of the fertilizer applied on the certified-seed and Presque Isle farms was of higher analysis than on the farms of the other group. For the same equivalent of plant food, fertilizers of relatively high analysis cost less per unit than fertilizers of relatively low analysis.[4]

*Barnyard manure.* Barnyard manure was applied to about one-seventh of the land on which potatoes were planted. The aver-

[4] Schrumpf, W. E. A study of the Organization and Management of Potato Farms in Aroostook County, Maine, Maine Agricultural Experiment Station Bulletin 378, pp. 47 and 48, 1935.

TABLE 6

*Number of Pounds of Plant Food (Nitrogen, Phosphoric Acid, and Potash) Applied per Acre of Potatoes for Three Groups of Potato Farms in Aroostook County, Maine, Average 1928, 1929, and 1930*

| Item | Pounds of Plant Food | | | Per cent of Total Pounds | | |
|---|---|---|---|---|---|---|
| | Presque Isle Farms | Houlton Farms | Certified-seed Farms | Presque Isle Farms | Houlton Farms | Certified-seed Farms |
| Nitrogen (N) | 90 | 89 | 89 | 21.0 | 21.1 | 20.7 |
| Phosphoric acid ($P_2O_5$) | 170 | 168 | 169 | 39.7 | 39.9 | 39.4 |
| Potash ($K_2O$) | 168 | 164 | 171 | 39.3 | 39.0 | 39.9 |
| Total | 428 | 421 | 429 | 100.0 | 100.0 | 100.0 |
| Cost per 100 pounds of plant food | $9.38 | $9.78 | $9.31 | | | |

age rate of application was 10.6 tons on the Houlton farms, 8.3 tons on the certified-seed farms, and 8.0 tons on the Presque Isle farms per acre manured. The average application per acre planted was 1.56 tons valued at $4.53 on the Houlton farms, 1.46 tons valued at $4.52 on the certified-seed farms, and 1.02 tons valued at $3.04 on the Presque Isle farms.

*Green-manure crops.* Green-manure crops were plowed under for 1.4 per cent of the total potato acreage planted on the certified-seed farms, 1.1 per cent on the Houlton farms, and 0.6 per cent on the Presque Isle farms. The amount of green manure plowed under for potatoes averaged 6.6 tons (green weight) on the Presque Isle farms, 6.5 tons on the certified-seed farms, and 5.3 tons on the Houlton farms. The value of the green-manure crops per acre of potatoes planted averaged 63 cents on the certified-seed farms, 27 cents on the Houlton farms, and 22 cents on the Presque Isle farms according to the farmers' estimates of the value of the crop for hay in the field where grown.

*Spray and dust.* Spray includes home-made bordeaux, prepared mixtures, calcium arsenate, and arsenate of lead. Dust includes copper-lime dust materials whether with or without arsenic and lead poisons.

The cost of spray and dust materials was largest on the Houlton farms, $3.99 per acre; next largest on the certified-seed farms,

$3.89 per acre; and smallest on the Presque Isle farms, $3.71 per acre. The number of applications of spray and dust material averaged 5.6 on the certified-seed farms, 5.0 on the Presque Isle farms, and 4.4 on the Houlton farms.

*Cost of Harvesting Potatoes.* The cost per acre of harvesting (digging and picking up) potatoes was highest ($19.92) on the certified-seed farms, next highest ($18.57) on the Presque Isle farms, and lowest ($18.12) on the Houlton farms. On account of differences in yield rates, however, the cost per barrel of harvesting potatoes was highest (17.0 cents) on the Houlton farms and lowest (15.6 cents) on the certified-seed farms. The harvesting cost on the Presque Isle farms was 15.9 cents per barrel.

More than 92 per cent of the harvesting cost was for labor, power, and equipment in each of the groups of farms. The largest proportion was for man labor which averaged 68.5 per cent of the harvesting cost on the Houlton farms, 70.8 per cent on the Presque Isle farms, and 72.7 per cent on the certified-seed farms. Horse labor accounted for 7.8 per cent of the harvesting cost on the certified-seed farms, 9.5 per cent on the Presque Isle farms, and 13.9 per cent on the Houlton farms. The cost for equipment averaged 8.2 per cent of the harvesting cost on the Houlton farms, 9.4 per cent on the certified-seed farms, and 9.7 per cent on the Presque Isle farms. The cost for barrels and baskets amounted to more than 6 per cent of the harvesting cost in each of the three groups (Table 7).

*Man labor.* The largest amount of man labor in harvesting an acre of potatoes was expended on the Houton farms, and the smallest amount on the Presque Isle farms. On the Houlton farms 23.2 hours of man labor costing $12.42 were used per acre compared with 22.8 hours costing $14.47 on the certified-seed farms, and 21.0 hours costing $13.15 on the Presque Isle farms.

*Horse labor.* Horse labor in harvesting potatoes averaged 10.5 hours, 6.9 hours, and 6.7 hours for the Houlton, Presque Isle, and certified-seed farms respectively. The cost of horse labor was $2.51 per acre on the Houlton farms, $1.76 on the Presque Isle farms, and $1.56 on the certified-seed farms.

*Tractor use.* The amount of tractor use in harvesting potatoes was small. Tractor use averaged 0.3 hour per acre on the certified-

## TABLE 7

*Costs of Harvesting Potatoes for Three Groups of Potato Farms in Aroostook County, Maine. Average 1928, 1929, and 1930*

| Item | Average per Acre | | | | | | Per cent of Total Cost | | |
|---|---|---|---|---|---|---|---|---|---|
| | Presque Isle Farms | | Houlton Farms | | Certified-seed Farms | | Presque Isle Farms | Houlton Farms | Certified-seed Farms |
| | Amount | Cost | Amount | Cost | Amount | Cost | | | |
| Man labor | 21.0 hr. | $13.15 | 23.2 hr. | $12.42 | 22.8 hr. | $14.47 | 70.8 | 68.5 | 72.7 |
| Horse labor | 6.9 hr. | 1.76 | 10.5 hr. | 2.51 | 6.7 hr. | 1.56 | 9.5 | 13.9 | 7.8 |
| Tractor use | 0.2 hr. | 0.23 | 0.2 hr. | 0.17 | 0.3 hr. | 0.30 | 1.2 | 0.9 | 1.5 |
| Automobile use | | 0.19 | | 0.24 | | 0.20 | 1.0 | 1.3 | 1.0 |
| Equipment use | | 1.80 | | 1.48 | | 1.88 | 9.7 | 8.2 | 9.4 |
| Total labor, etc. | | $17.13 | | $16.82 | | $18.41 | 92.2 | 92.8 | 92.4 |
| Barrels and baskets | | $ 1.22 | | $ 1.11 | | $ 1.25 | 6.6 | 6.1 | 6.3 |
| Other costs | | 0.22 | | 0.19 | | 0.26 | 1.2 | 1.1 | 1.3 |
| Total barrels, baskets, etc. | | $ 1.44 | | $ 1.30 | | $ 1.51 | 7.8 | 7.2 | 7.6 |
| Total harvesting costs | | $18.57 | | $18.12 | | $19.92 | 100.0 | 100.0 | 100.0 |
| Acres of potatoes per farm | 43 A | | 30 A | | 50 A | | | | |
| Yield per acre | 116.8 bbl. | | 106.3 bbl. | | 127.5 bbl. | | | | |
| Cost per barrel | | 15.9 cents | | 17.0 cents | | 15.6 cents | | | |

seed farms and 0.2 hour on the farms of each of the other groups. The cost of the tractor work per acre was 30 cents, 23 cents, and 17 cents respectively for the certified-seed, the Presque Isle, and the Houlton farms.

*Equipment use.* The cost of the use of farm equipment amounted to $1.88 per acre harvested on the certified-seed farms, $1.80 on the Presque Isle farms, and $1.48 on the Houlton farms.

*Barrels and baskets.* The cost for barrels and baskets per acre of potatoes harvested was $1.25 on the certified-seed farms, $1.22 on the Presque Isle farms, and $1.11 on the Houlton farms.

*Cost of Storing Potatoes.* The cost of storing potatoes includes placing in storage, the expense for storage space, air shrinkage of potatoes in storage, insurance on potatoes, and interest on the value of the potatoes for the time they were in storage.

The certified-seed farms had the highest storage cost, $43.80 per acre of potatoes harvested. The Presque Isle farms came next with $33.04 per acre and the Houlton farms last with $24.98 per acre.

The average amount of potatoes taken out of storage per acre of potatoes produced was 103.0 barrels on the certified-seed farms, 85.9 barrels on the Presque Isle farms, and 65.8 barrels on the Houlton farms. Much of this variation is due to differences in the amounts of potatoes sold directly from the field. The storing cost per barrel of potatoes taken from storage was 42 cents on the certified-seed farms, 39 cents on the Presque Isle farms, and 38 cents on the Houlton farms.

The cost of labor, power, and equipment accounted for 22.5 per cent of the storage cost on the Houlton farms, 19.9 per cent on the Presque Isle farms, and 17.7 per cent on the certified-seed farms. The cost for storage space was 17.8 per cent, 17.7 per cent, and 15.6 per cent of the storing cost on the certified-seed, Houlton, and Presque Isle farms respectively. Air shrinkage of potatoes in storage accounted for 51.3 per cent of the storing cost on the Presque Isle farms, 49.1 per cent on the certified-seed farms and 47.1 per cent on the Houlton farms. These percentages, of course, would vary from year to year according to the price of potatoes. The cost of insurance and interest together amounted to 12.4 per cent of the storing cost on the certified-seed farms, 9.4 per cent on

the Presque Isle farms, and 8.3 per cent on the Houlton farms. Barrels and other costs were 4.4 per cent, 3.8 per cent, and 3.0 per cent of the total on the Houlton, Presque Isle, and certified-seed farms respectively.

*Man labor.* The man labor used in storing potatoes on the certified-seed farms amounted to 7.7 hours costing $3.06 per acre of potatoes produced. This may be compared with 7.1 hours costing $2.67 on the Presque Isle farms, and 5.8 hours costing $2.08 on the Houlton farms.

*Horse labor.* The horse labor expended in storing potatoes was 6.9 hours costing $1.57 per acre of potatoes harvested, 6.4 hours costing $1.58, and 5.7 hours costing $1.34 respectively on the certified-seed farms, the Presque Isle farms, and the Houlton farms.

*Truck use.* Truck work storing potatoes averaged 1.9 hours per acre on the certified-seed farms, 1.5 hours on the Houlton farms, and 1.1 hours on the Presque Isle farms. The cost of truck work was $2.07, $1.61, and $1.39 in the respective groups.

*Storage space.* Potatoes were stored in farmers' storehouses on the farms or in storage houses at the railroad sidings. A few of the farmers owned storage houses at the sidings but most of this kind of space was hired. As noted, the certified-seed farms had more potatoes stored per acre than the other groups. Largely for this reason they also had the highest cost for storage space. The Presque Isle farms had the next largest, and the Houlton farms the smallest.

The cost of hired storage for the certified-seed farms was larger than the cost of farmers' storage, $4.10 per acre compared with $3.67 per acre. Also for the Houlton farms the cost of $2.33 for hired storage was larger than the cost of $2.09 for farmers' storage. For the Presque Isle farms, however, the cost of farmers' storage ($3.12) was larger than the cost of hired storage ($2.05).

*Shrinkage.* On the certified-seed farms the average air shrinkage per acre of potatoes produced amounted to 9.0 barrels valued at $21.52. On the Presque Isle farms air shrinkage was 8.1 barrels valued at $16.96 and on the Houlton farms, 6.2 barrels valued at $11.77.

*Insurance.* Relatively more of the potatoes on the certified-seed farms were insured than on the farms of the other two groups.

The cost of insurance on potatoes in storage was $2.43 per acre for the certified-seed farms, $1.08 for the Presque Isle farms, and 52 cents for the Houlton farms.

*Interest.* The interest charge at the rate of 5 per cent per year for the average time the potatoes were in storage amounted to $3.02 per acre on the certified-seed farms, $2.03 on the Presque Isle farms, and $1.55 on the Houlton farms.

*Barrels.* The cost for barrels used in storing potatoes was $1.05 per acre on the certified-seed farms, $1.01 on the Presque Isle farms, and 90 cents on the Houlton farms. The costs of storing potatoes are shown in Table 8.

*Cost of Selling Potatoes.* Potatoes were sold either directly from the field at the time of harvesting or from storage houses at a later date. Selling potatoes that were stored in track storage houses incurred no cost to the producers except in the cases when the producer graded and loaded his own potatoes.

Practically all of the potatoes that were graded and loaded into cars by the producers were from the certified-seed farms. Largely for this reason the selling cost for these farms per acre of potatoes grown is nearly twice as high as for either the Houlton or the Presque Isle farms. The cost of selling potatoes for the three groups of farms in the order named was $21.63 per acre, $11.99 per acre, and $11.98 per acre.

On the certified-seed farms 110.4 barrels of potatoes were sold from each acre produced, on the Presque Isle farms 100.6 barrels, and on the Houlton farms 91.7 barrels. The cost of selling per barrel of potatoes sold was 20 cents on the certified-seed farms, 13 cents on the Houlton farms, and 12 cents on the Presque Isle farms.

Labor, power, and equipment accounted for more than 95 per cent of the cost of selling potatoes on the Presque Isle and the Houlton farms compared with 65 per cent on the certified-seed farms. Nearly 34 per cent of the selling cost on the certified-seed farms was for sacks and certification tags.

*Man labor.* The man labor expended in selling potatoes on the certified-seed farms amounted to 23.0 hours per acre of potatoes produced compared with 13.9 hours on the Houlton farms and 13.3 hours on the Presque Isle farms. The cost of this man labor

## TABLE 8

*Costs of Storing Potatoes for Three Groups of Potato Farms in Aroostook County, Maine, Average 1928, 1929, and 1930*

| Item | Average per Acre | | | | | | Per cent of Total Cost | | |
|---|---|---|---|---|---|---|---|---|---|
| | Presque Isle Farms | | Houlton Farms | | Certified-seed Farms | | Presque Isle Farms | Houlton Farms | Certified-seed Farms |
| | Amount | Cost | Amount | Cost | Amount | Cost | | | |
| Man labor | 7.1 hr. | $ 2.67 | 5.8 hr. | $ 2.08 | 7.7 hr. | $ 3.06 | 8.1 | 8.3 | 7.0 |
| Horse labor | 6.4 hr. | 1.58 | 5.7 hr. | 1.34 | 6.9 hr. | 1.57 | 4.8 | 5.4 | 3.6 |
| Truck use | 1.1 hr. | 1.39 | 1.5 hr. | 1.61 | 1.9 hr. | 2.07 | 4.2 | 6.4 | 4.7 |
| Automobile use | | 0.18 | | 0.24 | | 0.19 | 0.5 | 1.0 | 0.4 |
| Equipment use | | 0.75 | | 0.36 | | 0.87 | 2.3 | 1.4 | 2.0 |
| Total labor, etc. | | $ 6.57 | | $ 5.63 | | $ 7.76 | 19.9 | 22.5 | 17.7 |
| Farmers' storage | | $ 3.12 | | $ 2.09 | | $ 3.67 | 9.4 | 8.4 | 8.4 |
| Hired storage | | 2.05 | | 2.33 | | 4.10 | 6.2 | 9.3 | 9.4 |
| Shrinkage | 8.1 bbl. | 16.96 | 6.2 bbl. | 11.77 | 9.0 bbl. | 21.52 | 51.3 | 47.1 | 49.1 |
| Insurance on stored potatoes | | 1.08 | | 0.52 | | 2.43 | 3.3 | 2.1 | 5.5 |
| Interest on stored potatoes | | 2.03 | | 1.55 | | 3.02 | 6.1 | 6.2 | 6.9 |
| Barrels | | 1.01 | | 0.90 | | 1.05 | 3.1 | 3.6 | 2.4 |
| Other costs | | 0.22 | | 0.19 | | 0.25 | 0.7 | 0.8 | 0.6 |
| Total storage, etc. | | $26.47 | | $19.35 | | $36.04 | 80.1 | 77.5 | 82.3 |
| Total storing costs | | $33.04 | | $24.98 | | $43.80 | 100.0 | 100.0 | 100.0 |
| Potatoes removed from storage per acre | 85.9 bbl. | | 65.8 bbl. | | 103.0 bbl. | | | | |
| Storing cost per barrel removed | | 39 cents | | 38 cents | | 42 cents | | | |

## TABLE 9

*Costs of Selling Potatoes for Three Groups of Potato Farms in Aroostook County, Maine, Average 1928, 1929, and 1930*

| Item | Average per Acre | | | | | | Per cent of Total Cost | | |
|---|---|---|---|---|---|---|---|---|---|
| | Presque Isle Farms | | Houlton Farms | | Certified-seed Farms | | Presque Isle Farms | Houlton Farms | Certified-seed Farms |
| | Amount | Cost | Amount | Cost | Amount | Cost | | | |
| Man labor | 13.3 hr. | $ 5.04 | 13.9 hr. | $ 4.97 | 23.0 hr. | $ 8.91 | 42.1 | 41.4 | 41.2 |
| Horse labor | 16.2 hr. | 3.92 | 14.0 hr. | 3.04 | 10.7 hr. | 2.20 | 32.7 | 25.4 | 10.2 |
| Truck use | 1.7 hr. | 1.78 | 2.7 hr. | 2.66 | 1.5 hr. | 1.88 | 14.9 | 22.2 | 8.7 |
| Automobile use | | 0.18 | | 0.24 | | 0.19 | 1.5 | 2.0 | 0.9 |
| Equipment use | | 0.57 | | 0.52 | | 0.88 | 4.7 | 4.3 | 4.0 |
| Total labor, etc. | | $11.49 | | $11.43 | | $14.06 | 95.9 | 95.3 | 65.0 |
| Sacks | | $ | | $ | | $ 5.52 | | | 25.5 |
| Certification tags | | | | | | 1.80 | | | 8.3 |
| Other costs | | 0.49 | | 0.56 | | 0.25 | 4.1 | 4.7 | 1.2 |
| Total sacks, etc. | | $ 0.49 | | $ 0.56 | | $ 7.57 | 4.1 | 4.7 | 35.0 |
| Total selling costs | | $11.98 | | $11.99 | | $21.63 | 100.0 | 100.0 | 100.0 |
| Potatoes sold per acre | 100.6 bbl. | | 91.7 bbl. | | 110.4 bbl. | | | | |
| Cost per barrel of potatoes sold | | 12 cents | | 13 cents | | 20 cents | | | |

for the three groups of farms in the order named was $8.91, $4.97, and $5.04 per acre.

*Horse labor.* The largest amount of horse labor in selling potatoes was used on the Presque Isle farms and the smallest amount on the certified-seed farms. Horse labor on the Presque Isle farms amounted to 16.2 hours costing $3.92 per acre of potatoes produced, on the Houlton farms 14.0 hours costing $3.04, and on the certified-seed farms 10.7 hours costing $2.20.

*Truck use.* More truck hours were used on the Houlton farms in selling potatoes than on the farms of either of the other groups. The average amount of truck use per acre in selling potatoes was 2.7 hours on the Houlton farms, 1.7 hours on the Presque Isle farms, and 1.5 hours on the certified-seed farms. The cost per acre for truck use was $2.66 on the Houlton farms, $1.88 on the certified-seed farms, and $1.78 on the Presque Isle farms. The costs of selling potatoes are shown in Table 9.

MOTIVE POWER ON CENTRAL-MAINE POTATO FARMS. Information on motive power covering the crop year, 1934, was obtained on 90 farms in the central-Maine potato area. A tentative summary of the cost of maintaining work horses, standard tractors, and general-purpose tractors is presented.

The potato acreage on the 90 farms averaged 30.2 acres per farm. There were 218 work horses valued at $39,589, 15 standard tractors valued at $3,042, and 43 general-purpose tractors valued at $22,265. The average value per farm of horses was $440, of standard tractors $34, and of general-purpose tractors $247 (Table 10).

TABLE 10

*Motive Power on 90 Central-Maine Potato Farms in 1934: Number and Value of Horses and Tractors*

| Item | Number | Value | Value per Farm |
|---|---|---|---|
| Horses | 218 | $39,589 | $440 |
| Standard tractors | 15 | 3,042 | 34 |
| General-purpose tractors | 43 | 22,265 | 247 |

*The Cost of Maintaining a Work Horse.* The average cost of maintaining a work horse on the central-Maine potato farms was $198.47 per year. Credit for appreciation and manure amounted to $16.00 per year. The net cost was $182.47 per year. The cost of grain, man labor, and hay accounted for about three-fourths of the total cost, 36.0 per cent being for grain, 20.7 per cent for labor, and 19.0 per cent for hay.

Grain requirements averaged 120 bushels (mostly oats) valued at $71.36; man labor, 198 hours valued at $41.14; hay, 3.4 tons valued at $37.74; and bedding, 1.5 tons valued at $4.51.

The horses were valued at $182 per horse. There were 12.0 acres of potatoes per horse. The work hours averaged 847.5 per horse and the cost per hour of work averaged 21.5 cents (Table 11).

*The Cost of Maintaining a Standard Tractor.* The yearly maintenance cost of standard tractors was $106.49 per tractor. Of this amount 32.5 per cent was for gasoline and fuel oil, 26.0 per cent for depreciation, 11.0 per cent for repairs, and 10.9 per cent for lubrication.

The amounts of gasoline and fuel oil used averaged nearly the same, 128.2 gallons of gasoline and 124.7 gallons of fuel oil.

TABLE 11

*Motive Power on 90 Central-Maine Potato Farms in 1934: Cost of Maintaining a Work Horse*

| Item | Amount | Cost | Per cent of Cost |
|---|---|---|---|
| Hay | 3.4 Tons | $ 37.74 | 19.0 |
| Grain | 120.0 Bushels | 71.36 | 36.0 |
| Bedding | 1.5 Tons | 4.51 | 2.3 |
| Repair of harness | | 3.58 | 1.8 |
| Shoeing | | 9.22 | 4.7 |
| Veterinary service | | 1.06 | 0.5 |
| Man labor | 198 Hours | 41.14 | 20.7 |
| Depreciation | | 7.43 | 3.7 |
| Interest | | 9.11 | 4.6 |
| Housing | | 6.43 | 3.2 |
| Taxes | | 6.89 | 3.5 |
| Total cost | | $198.47 | 100.0 |
| Credit; appreciation and manure | | $ 16.00 | |
| Net cost | | 182.47 | |
| Average value per horse | | 182.02 | |
| Acres of potatoes per horse | | 12.0 Acres | |
| Average number of hours worked | | 847.5 Hours | |
| Cost per work hour | | 21.5 Cents | |

The cost of the gasoline ($22.71) averaged nearly twice the cost of the fuel oil ($11.92). Lubricating oil used averaged 15.6 gallons costing $10.11 and hard grease averaged 8.5 pounds costing $1.48. Man labor for servicing a standard tractor averaged 6.0 hours valued at $1.34.

The average value of the standard tractors was $202.83. The number of hours of work was 128.7 per tractor per year and the cost per work hour was 83 cents (Table 12).

*The Cost of Maintaining a General-Purpose Tractor.* Maintaining general-purpose tractors cost $255.89 per tractor. Of this amount 35.6 per cent was for gasoline and fuel oil, 26.6 per cent was for depreciation, 8.6 per cent for lubrication, and 7.8 per cent

TABLE 12

*Motive Power on 90 Central-Maine Potato Farms in 1934: Cost of Maintaining a Standard Tractor*

| Item | Amount | Cost | Per cent of Cost |
|---|---|---|---|
| Gasoline | 128.2 Gallons | $ 22.71 | 21.3 |
| Fuel Oil | 124.7 Gallons | 11.92 | 11.2 |
| Oil | 15.6 Gallons | 10.11 | 9.5 |
| Grease | 8.5 Pounds | 1.48 | 1.4 |
| Man labor | 6.0 Hours | 1.34 | 1.3 |
| Repairs | | 11.73 | 11.0 |
| Depreciation | | 27.67 | 26.0 |
| Interest | | 9.80 | 9.2 |
| Housing | | 5.00 | 4.7 |
| Taxes | | 4.73 | 4.4 |
| Total cost | | $106.49 | 100.0 |
| Average value per tractor | | $202.83 | |
| Average number of hours worked | | 128.7 Hours | |
| Cost per work hour | | 83 Cents | |

for repairs. More fuel oil than gasoline was used in the general-purpose tractors. The amount of fuel oil used averaged 529.4 gallons per tractor and the amount of gasoline 262.7 gallons. The cost of the gasoline was $41.28 and of the fuel oil $49.93. Oil for lubrication averaged 29 gallons costing $18.90 and grease 18.5 pounds costing $3.01. The average amount of man labor for servicing was 22 hours valued at $4.66.

The general-purpose tractors had an average value of $517.79.

These tractors were worked 447.2 hours per tractor per year and the average cost per work hour was 57 cents (Table 13).

TABLE 13

*Motive Power on 90 Central-Maine Potato Farms in 1934: Cost of Maintaining a General-Purpose Tractor*

| Item | Amount | Cost | Per cent of Cost |
|---|---|---|---|
| Gasoline | 262.7 Gallons | $ 41.28 | 16.1 |
| Fuel oil | 529.4 Gallons | 49.93 | 19.5 |
| Oil | 29.0 Gallons | 18.90 | 7.4 |
| Grease | 18.5 Pounds | 3.01 | 1.2 |
| Man labor | 22.0 Hours | 4.66 | 1.8 |
| Repairs | | 19.95 | 7.8 |
| Depreciation | | 68.02 | 26.6 |
| Interest | | 27.11 | 10.6 |
| Housing | | 4.84 | 1.9 |
| Taxes | | 18.19 | 7.1 |
| Total cost | | $255.89 | 100.0 |
| Average value per tractor | | $517.79 | |
| Average number of hours worked | | 447.2 Hours | |
| Cost per work hour | | 57 Cents | |

WIREWORM CONTROL. John H. Hawkins. The results of several years' work with various methods of wireworm control are summed up in Bulletin 381 which is now available. Work continued this year bears out the data previously reported. A study of the life history of the wireworms is being continued and crop rotations are being studied farther to determine the effect on wireworm control. The observations of the effect of wireworm populations of various intensities upon potatoes are also being continued.

INSECTS IN RELATION TO THE TRANSMISSION OF VIRUS DISEASES. G. W. Simpson. Major emphasis has been placed as in the past on experimental seed plots located on various farms in different parts of Aroostook County. These seed plots are being maintained under actual farming conditions and in most cases are serving as sources of seed for the coöperating farmers. In each case the roguing of the plots is being done by an experienced individual under the direct supervision of the Department of Plant Pathology. Aphid counts and other insect notes are being taken at regular intervals in an endeavor to learn more surely the true

relationship existing between the insect population and the incidence of the virus diseases present in the seed stocks.

It is becoming increasingly evident that the losses attributable to virus diseases can be reduced only by community effort. In those rare cases where farms are located, either deliberately or otherwise, at some distance from other farms, there seems to be no reason why, with the proper precautions, seed stocks cannot be maintained year after year practically free from virus diseases. In at least two cases in these experiments, seed stocks, now in their sixth season under observation, are more nearly free from virus diseases than they were when first imported. Other seed stocks not so well isolated and hence subject to the influence of diseased seed stocks in the immediate vicinity have been maintained somewhat less successfully. It appears to be well nigh impossible to produce true foundation seed in proximity to diseased fields. If all members of a community do not coöperate in using good seed, there is little chance for an individual in that area to produce foundation seed stock.

About twenty-five hundred tubers were indexed in the greenhouse during the winter. As has been the case in previous winters, the reading obtained serves to indicate the degree of freedom from virus diseases of the seed stock tested as well as to provide seed for planting in foundation plots.

In the greenhouse the study of the ability of various numbers of the peach aphid (*Myzus persicae* Sulz.) to transmit leafroll and mosaic was continued. The results of the previous season's tests indicate that leafroll is much more easily transmitted to young potato plants than is mild mosaic.

POTATO FLEA-BEETLE CONTROL. G. W. Simpson. Potato flea beetles appeared in large numbers on the emerging potato plants late in June, indicating that hibernation conditions last winter were quite favorable to this insect. Spray plots have been planted with the idea of testing the relative effectiveness of bordeaux mixture, basic copper, basic copper with lime added, and barium fluosilicate in the control of this potato insect. These plots are being conducted in coöperation with the Department of Plant Pathology.

## SMALL FRUITS

Blueberry Investigations. *Fertilizers.* Frederick B. Chandler, Joseph A. Chucka, and Irvin C. Mason. This year our fertilizer studies in the vicinity of Harrington and Deblois will have a "first crop." The condition of the fertilizer plots, judging by the number of blossoms present in June, indicates an increase in the yield over the check plots.

*Pollination.* Frederick B. Chandler and Irvin C. Mason. This season all of the major pollination studies made in past years were repeated to complete the data on hand pollination and the use of bees in cages, studies being made in York, Hancock, and Washington Counties. The work done in the past has shown that wild bees are not numerous enough in most fields to give a maximum set of fruit. The Agricultural Experiment Station now has five hives of bees which were in the blueberry field at pollinating time and it is planned to divide these to make eight hives for study next year.

*Burning.* Frederick B. Chandler and Irvin C. Mason. The equipment on the market to burn weeds has been tried to burn blueberry land. Burning with this equipment was found to be cheaper than the customary method of using hay. The cost of oil was between one and two dollars per acre depending upon the land. One man could burn about an acre in a day. The burners used were loaned by the Aeroil Burner Company, Inc., Park Avenue at 13th Street, West New York, New Jersey, and by the Hauck Manufacturing Company, 126-134 Tenth Street, Brooklyn, New York. In addition an attempt was made to construct a burner that would burn a strip about eight feet wide. This burner was not very satisfactory but it gave valuable information for use in further studies of burning machines to be used on large areas.

*Weed Control.* Frederick B. Chandler and Irvin C. Mason. The sweet-fern plots have not been cut for two years yet those plots which were cut in the past between the first of July and the middle of August show practically no sweet fern. An increasing number of the blueberry growers are practicing this time of cutting with very good success.

Most of the weed control work this year will be on the herbaceous weeds such as rabbit foot clover, hop clover, and hawkweed.

Studies will also be made on some of the shrubs particularly on bush honeysuckle. Sulphuric acid which was used a great deal last year will be used again this year. Sulphuric acid is relatively cheap and quite easy to handle and is not as hazardous to handle as the chlorates. This acid in solutions from 3 to 5 per cent will kill all leaves and herbaceous stems but several years will be required to see whether or not the acid will kill the roots and underground stems.

BLUEBERRY INSECTS. Frank H. Lathrop. Observations and experiments on the biology and control of insect pests that attack blueberries are being continued.

*The Blueberry Fruit Fly* (*Rhagoletis mendax* Curran). The investigation of the blueberry fruit fly consists mainly of a study to improve the control of the pest by means of insecticide applications. In this connection it is important to study the effects of calcium arsenate upon the blueberry plants, and to test possible methods for reducing the injurious effects of the insecticide. Observations in past seasons have shown that calcium arsenate applied to blueberry foliage is likely to aggravate injuries caused by fungus diseases or by leaf-feeding insects. In the spring of 1936, experimental plots have been arranged on excellent blueberry land, and one-half of the area has been given two applications of copper-lime dust for the control of fungus diseases. Later in the season it is planned to apply calcium arsenate to a portion of the land previously dusted with copper-lime, and to duplicate the treatment on land that was not previously treated.

An experiment to test the effectiveness of derris dust as a substitute for calcium arsenate for the control of the blueberry fruit fly will also be undertaken.

*The Blueberry Thrips* (*Frankliniella vaccinii* Morgan). Studies of the life history and control of the blueberry thrips during the season of 1936 were conducted near Brunswick.

The thrips began their attacks as soon as the developing blueberry leaves had pushed well out of the buds. Thrips larvae were found within the protection of the unfolding leaves as early as May 16. External evidences of the thrips injury did not appear until a week or ten days later. About the time that the blueberries on early areas were in full bloom (May 29) typical clusters of

rolled leaves, resulting from the thrips, were common. During the first week in June the characteristic red discoloration of the curled leaves developed, and the injury became much more conspicuous (Fig. 43).

FIG. 43. Typical clusters of tightly curled leaves mark the plants infested by blueberry thrips. The thrips are minute insects, almost microscopically small, that during the growing period live, feed, and multiply within the protection of the curled leaves.

The life history of the thrips makes it appear that the most opportune time for the application of insecticides is in the early spring as the thrips emerge from their winter quarters, but before they gain the protection of the leaf clusters. In the spring of 1936 dust applications were made to small plots on badly infested blueberry land, on May 22, May 29, and June 13. On each date the following materials were used: derris dust (containing 0.75 per cent rotenone), a mixture of equal parts of derris dust and sulphur, sulphur dust, 3 per cent nicotine dust, and flake naphthalene. The

rate of application to the plots was not carefully determined, but a heavy application was made in each case.

The effectiveness of the materials for the control of thrips decreased in the following order: sulphur, derris-sulphur, derris, nicotine, naphthalene. None of the materials gave satisfactory control. Naphthalene showed no beneficial effect. Sulphur showed sufficient promise to warrant further tests next year, when the knowledge gained from the life history studies conducted this year should permit more timely application of insecticides.

*The Blueberry Flea Beetle* (*Haltica torquata* LeConte). During the season of 1936 a general outbreak of the blueberry flea beetle occurred in a number of localities in Washington, Hancock, and Knox Counties. In some places considerable areas of blueberries were defoliated, and the crop on badly infested areas was greatly reduced.

The life history of the blueberry flea beetle, as published by William Colcord Woods in Maine Experiment Station Bulletin 273, is briefly as follows: From eggs which have passed the winter on or near the blueberry plants, the flea beetle larvae hatch in the spring just as the leaves begin to push out of the buds. The larvae feed upon the blueberry leaves until late June, by which time most of the larvae have become full-fed. The full-grown larvae drop to the soil where they undergo transformation to the adult stage. The adults appear in numbers and begin feeding upon the blueberry foliage early in July. During late July and early August the adults lay eggs, which are to remain over winter and hatch the next spring.

During the spring of 1936, evidences of destruction of the blueberry leaves by the larvae were apparent early in June. Even severe injury to the developing foliage may not be conspicuous, however, and is often overlooked by blueberry growers. The attack of large numbers of adult flea beetles in July as the berries are maturing results in serious defoliation of the plants and loss of fruit (Fig. 44).

While feeding, the flea beetles were usually concentrated in limited areas or spots, here and there, in the infested fields. As the plants were stripped of leaves, the beetles moved on to new feeding grounds.

Observations indicate that calcium arsenate dust protects the blueberry plants from both the larvae and the adult flea beetles. Most effective control was secured, however, by early applications to destroy the larvae before severe damage had been done to the plants.

FIG. 44. The attack of large numbers of blueberry flea beetles results in serious defoliation of the plants and reduction of the crop.

*The Blueberry Spanworm* (*Itame argillacearia* Packard). During the spring of 1936 an outbreak of this species of looper or measuring worm occurred on blueberry land over a considerable area in southern Maine and New Hampshire. A flight of large numbers of the adult moths was observed on blueberry land near Kennebunk in York County during late June, 1935. Injury to the developing foliage caused by the young larvae was noticed in the

early spring of 1936. By the middle of May the loopers were one-half or two-thirds grown, and the destruction of foliage had become conspicuous. The habit of the loopers of remaining motionless or hiding away during most of the day makes them difficult to see and they are likely to escape the attention of the growers, even after considerable damage has been done to the blueberry plants. During late May, the nearly full-grown loopers defoliated considerable areas of blueberries in some places. The crop was ruined on the defoliated areas.

Where the growers applied calcium arsenate dust to the plants, satisfactory protection from the loopers was secured. By making the application before the loopers had materially injured the foliage, reduction of the crop was prevented.

Specimens of the moths captured in the field near Kennebunk and of those reared from larvae were identified by Doctor William T. M. Forbes of Cornell University as typical *Itame argillacearia.*

It is interesting to note that moths of this species were reported by McDunnough[5] (p. 274) as occurring commonly in the blueberry regions near Ottawa, Ontario. Slingerland[6] observed an outbreak of what was probably this species on blueberry land in New Hampshire in 1897, and gave it the name, blueberry spanworm. Few references can be found concerning the species in publications on economic entomology. Probably outbreaks of the pest do not occur frequently.

## ANNOUNCEMENTS

Harmon G. Allen, upon his retirement from the University Board of Trustees was also retired from the Station Council.

The Maine Agricultural Experiment Station in coöperation with the Bureau of Chemistry and Soils of the United States Department of Agriculture resumed the project on the Soil Survey in a broad Land Use Study. Mr. Kenneth V. Goodman, from the Bureau of Chemistry and Soils, and Mr. Delmar Boynton Lovejoy, from the Maine Station, were assigned to this project. Mr. John

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[5] McDunnough, J., Notes on the Ribearia Group of the Genus *Itame* (Lepidoptera). Canadian Entomologist, Vol. 56, pp. 271-277. 1924.

[6] Slingerland, M. V., The Blueberry Spanworm (*Diastictis inceptaria* Walk.) . . . . Canadian Entomologist, Vol. 29, pp. 49-52, 1897.

Raymond Arno, a graduate of the University of Maine, class of 1936, was employed as an assistant during the summer season. The work was begun in York County.

Mr. Arthur Hawkins was appointed as Assistant Biologist in Plant Breeding and Nutrition, his appointment effective May 1, 1936. Mr. Hawkins is a graduate of Rutgers University and has the M.S. degree from the same institution.

Florence Lydia Markin (Lovejoy), Assistant in Plant Pathology, resigned, her resignation effective June 30, 1936.

Dr. Charles Andrew Brautlecht, Professor of Chemistry and Chemical Engineering, was assigned part time to the Station for a period of one year, beginning July 1, 1936. Dr. Brautlecht will carry a research project on the chemistry of potato starch.

George Farrington Dow was granted a leave of absence for the academic year 1936-37 to permit his continuing graduate study at Cornell University.

Merle Tyson Hilborn was appointed as Assistant Plant Pathologist, appointment effective July 1, 1936. Mr. Hilborn will continue a part of the work formerly done by Florence L. Markin but will continue also the study on the effects of winter injury to apple trees.

Mr. Bernie Elliott Plummer, Jr., was promoted to the rank of Associate Chemist and will devote two-thirds of his time to research and one-third to the Inspections Service. The change in Mr. Plummer's status is to be effective July 1, 1936.

Andrew Elwell Watson was appointed Acting Assistant Agricultural Economist, the appointment to become effective July 1, 1936. His appointment is for one year.

Frank Chadwick, Jr., was employed as Assistant in Biology beginning June 1, 1936, and will have charge of the dairy herd at Highmoor Farm.

## PROJECTS FOR 1935-1936

### Agricultural Economics

An economic study of the dairy industry in Maine.
An economic study of the potato industry in Maine.
Local market conditions and requirements of agricultural products in Maine, Cumberland County.
Agricultural credit in Maine.
Agricultural adjustment and land use project.

## BIOLOGY

The relation between shape and yield of apple trees.
Breeding new varieties of apples.
Nursery stock investigations and bud selection in relation to growth, yield, and color differences in the apple.
A study of the cause and possible control of "leaf scorch" of apple trees.
Causes of cross and self sterility in certain plants, particularly the apple, as determined through cytological and genetic study.
A study of picking date, effect of artificial preservatives, and other factors as related to problems of storage of Maine apple varieties.
To determine the cause of russeting of Golden Delicious apples and methods of preventing it.
A study of the fertilizer requirements of the native Maine blueberry.
Breeding investigations with the blueberry.
Blueberry field management.
Fruitfulness in the blueberry.
Weed control in blueberry fields.
Breeding investigations in canning crops with special reference to sweet corn and beans.
The mode of inheritance of milk production and associated characters in cattle.
Nutrition studies in dairy cattle.
The inheritance and nature of resistance to scab (*Cladosporium cucumerinum*) in *Cucumis sativus.*
Breeding and cultural investigations with garden crops.
Pasture improvement studies.
Fertilizer experiments with potatoes in rotation with grain and clover.
A study of clover failures in a potato rotation.
A study of various green manuring crops as a means of increasing and maintaining the organic matter content of potato soils in two, three, and four year rotations.
A study of soil conditions and other factors affecting development and control of potato scab.
A study of the physiology of reproduction in poultry.
Influence of anti-rachitic substances on growth in poultry.
The prevention of water heart in rutabagas, browning of cauliflower, and other physiological troubles of *Brassica.*
Fertilizer experiments with sweet corn and beans in a four-year rotation—oats, clover, sweet corn and beans and with sweet corn in a two-year rotation—sweet corn and an annual green manuring crop (mixture of oats and peas).
Cytological studies in species crosses.
Small grain variety test including oats, barley, and wheat.
Investigations dealing with the production of leguminous hays in Maine.
The fertilizer and cultural requirements of small fruits.
The vitamin assay of Maine-grown fruits and vegetables.

Breeding investigation with small fruits, particularly the raspberry and strawberry.
To study the physiological causes of winter injury in raspberries.
A study of methods of improving fertility in orchard soils.

## Chemistry

### INSPECTION

Inspection of feeding stuffs.
Inspection of fertilizers.
Inspection of foods and drugs.
Inspection of fungicides and insecticides.
Inspection of seeds.
Inspection of gasolines and oils.
Calibration of creamery glassware.
Inspection of milk and cream.
Miscellaneous analyses.

### INVESTIGATION

Chemical analyses in connection with the problem of nutrition and growth of poultry and dairy cattle. (In coöperation with the Biology Department.)
Soil analyses investigation and analysis of materials used in connection with the permanent rotation and fertility experiments at Aroostook Farm. (In coöperation with the Biology Department.)
A comparison of copper fungicides as to the adherence of the copper contents to potato foliage in spraying and dusting. (In coöperation with the Plant Pathology Department.)
The determination of the amounts of spray residues on apples. (In coöperation with the Entomology Department.)
Miscellaneous analyses.

## Entomology

Aphid investigations with special reference to the different food plants of migratory species.
A study of apple maggot problems, including dispersion.
Insects affecting the blueberry.
The cabbage maggot.
Control of the cabbage maggot.
Experiments in the control of the cucumber beetle and other insects.
Cutworms affecting field and garden crops.
Insects in relation to the transmission of virus diseases of potatoes.
Garden slug control.
Wireworms affecting field and garden crops.
The Mexican bean beetle.
The carrot rust fly.
A study of the potato flea beetle with special reference to its control.

### HOME ECONOMICS

The economic utilization of electricity in food preparation in Maine rural homes.

The factors affecting the cooking quality of potatoes.

A study of the financing by Maine families of the higher education of their children in Maine institutions.

Food habits and nutritional status of children in selected communities in Maine.

The effect of an improved diet upon the health and nutritive condition of grade school children in Mars Hill, Maine.

The antiscorbutic value of home canned pickles of various types used in Maine.

The economic management of kerosene cook stoves to secure palatability of product in Maine farm households.

### PLANT PATHOLOGY

Apple scab control.

Blueberry diseases.

Cucurbit disease control.

Differentiation and dissemination of potato virus diseases.

Dusting and spraying potatoes.

Economic effects and control of potato virus diseases.

Histology and ecology of potato tuber rots.

Identification and dissemination of causes of potato rots.

Seed disinfection of potatoes.

Stem-end browning of potato tubers.

Epidemiology, economic effects and control of bacterial wilt (Stewart's disease) of corn.

Plant disease survey and miscellaneous diseases. Annual recording, through correspondence and observations, of the prevalence and severity of plant diseases, and preliminary experiments on miscellaneous diseases that develop importance.

Apple tree winter injury: effects, recovery and prevention.

## PUBLICATIONS

The Station is organized so that the work of investigation is distinct from the work of inspection. The results of investigation are published in the bulletins of the Station and in scientific journals, both foreign and domestic. The bulletins for the year make up the annual report. The results of the work of inspection are printed in publications known as Official Inspections. These are paged independently of the bulletins and may be bound with the annual report as an appendix thereto. Miscellaneous publications, consisting of newspaper notices of bulletins and newspaper articles

which are not paged consecutively and for the most part are not included in the annual report, also are issued during the year.

## BULLETINS ISSUED IN 1935-1936

No. 380. Summary Report of Progress 1935. 120 pages.
No. 381. The Bionomics and Control of Wireworms in Maine. 146 pages.
No. 382. Maine Agriculture in 1935. A Statistical Presentation. 150 pages.
No. 383. Factors Affecting the Cooking Quality of Potatoes. 92 pages.
No. 384. Report of Progress for Year Ending June 30, 1936. 55 pages.

## OFFICIAL INSPECTIONS ISSUED IN 1935-1936

No. 155. Foods and Drugs. 20 pages.
No. 156. Commercial Feeding Stuffs, 1934-35. 54 pages.
No. 157. Commercial Fertilizers, 1935. 42 pages.
No. 158. Commercial Agricultural Seeds, 1935. Fungicides and Insecticides, 1935. 24 pages.
No. 159. Foods and Drugs. 18 pages.

## ABSTRACTS OF PAPERS PUBLISHED BY THE STATION IN 1935-1936 BUT NOT INCLUDED IN THE BULLETINS

A complete list of all the bulletins issued by and from the Station in 1935-36 is given on page 439 of this Report. The following pages contain abstracts of the papers published during the year and not included in the Bulletins or Official Inspections.

### LIST OF DISTINCT POTATO VIRUSES*

Twenty-six diseases apparently caused by 26 distinct viruses, respectively, alone or in combination with some other virus, are: (1) tobacco mottle and/or ringspot of J. Johnson, (2) tobacco ringspot of Virginia, (3) tobacco mosaic, (4) cucumber mosaic, (5-9) Green Mountain rugose, mild, crinkle, leaf-rolling, and interveinal mosaics, (10) aucuba mosaic, (11) calico of Porter, (12) Green Mountain streak, (13) streak of Koch and Johnson, (14) tomato spotted wilt, (15) bigarrure of Verplancke, (16) leaf roll, (17) apical leaf roll of Schultz and Bonde, (18) witches' broom, (19) yellow dwarf, (20) aster yellows, (21) beet curly top, (22) spindle tuber, (23) unmottled curly dwarf, (24) transmissible low-growing habit of M'Intosh, (25) pseudonetnecrosis, and (26) internal spotting in tubers.

* This is an abstract of a paper by Donald Folsom and Reiner Bonde, having the same title and published in the Amer. Potato Jour. 13:14-16. 1936.

### SEED-POTATO TREATMENT FOR RHIZOCTONIA CONTROL IN NORTHEASTERN MAINE, 1929 TO 1933†

In northeastern Maine, Irish Cobbler tubers infected with Rhizoctonia (black scurf) were given various seed treatments. Tubers without sclerotia on them were used, both treated and non-treated, to study soil infestation. Field-run Green Mountain tubers with a slight infection of black scurf were also treated. Special methods were used in barn, field, and statistical laboratory to increase the reliability of the results.

Seed treatment increased the yield rate only in the scurfy Cobblers, where it also usually increased the stand, increased the average vigor of the plants, reduced the injury from stem lesions, and reduced the percentage of scurfy tubers harvested. Rhizoctonia control was as good with the standard corrosive sublimate, 1.5-hour soak, as with any treatment, and other effective treatments, such as the acidulated corrosive sublimate 3-minute treatment and the yellow mercuric oxide dip, were sometimes injurious. Slightly inferior results were secured with certain organic mercury dips. Promising results were given by a dip treatment with corrosive sublimate solution 1-1,200 and potassium iodide 1-400. Seed-piece decay was not found and scurf from soil infestation was very slight.

## METEOROLOGICAL OBSERVATIONS

The Station is indebted to the Department of Physics of the University for the meteorological summary for 1935-36 which appears on the following page.

The instruments used are located on the University campus at Lat. 44° 54′ 2″ N., Long. 68° 40′ 5″ W., Elevation 135 feet. They are the same as those used in preceding years and include: maximum and minimum thermometers, rain gauge, self-recording anemometer, vane, and barometers. The observations at Orono now form an almost unbroken record of sixty-seven years.

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† This is an abstract of a paper by W. P. Raleigh and Reiner Bonde, having the same title and published in Phytopath. *26*:321-343. 1936.

# METEOROLOGICAL SUMMARY FOR 1935-1936
## U. of M. Orono, Maine

| 1935-1936 | 1935 | | | | | | 1936 | | | | | | Average | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | July | August | September | October | November | December | January | February | March | April | May | June | | |
| Highest temperature | 95 | 104 | 84 | 76 | 64 | 46 | 50 | 48 | 72 | 79 | 86 | 88 | ------- | ------- |
| Lowest temperature | 46 | 45 | 30 | 24 | 16 | –6 | –16 | –10 | –7 | 26 | 26 | 39 | ------- | ------- |
| Mean temperature | 72.43 | 69.25 | 56.53 | 47.98 | 38.81 | 21.45 | 20.96 | 18.86 | 39.62 | 41.60 | 54.46 | 63.23 | 45.43 | ------- |
| Mean temperature in 67 years | 67.23 | 65.75 | 60.13 | 49.18 | 37.13 | 22.98 | 16.46 | 19.01 | 30.15 | 39.43 | 51.04 | 61.33 | 43.32 | ------- |
| Total precipitation in inches | 2.25 | 2.05 | 2.44 | 1.16 | 5.04 | 1.82 | 5.90 | 3.30 | 5.37 | 2.55 | 3.08 | 2.81 | ------- | 37.77 |
| Mean total precipitation in 67 years | 3.43 | 3.43 | 3.48 | 3.92 | 3.53 | 3.52 | 3.93 | 4.14 | 3.62 | 2.86 | 3.25 | 3.46 | ------- | 42.57 |
| Number of days with .01 inch precipitation or more | 9 | 9 | 6 | 4 | 10 | 6 | 11 | 7 | 10 | 10 | 10 | 9 | ------- | 101 |
| Snowfall in inches | ------- | ------- | ------- | ------- | 2 | 8 | 19.50 | 16 | 13 | 2.50 | ------- | ------- | ------- | 61 |
| Mean snowfall in 67 years | ------- | ------- | ------- | .70 | 5.87 | 15.26 | 21.55 | 21.17 | 13.64 | 5.37 | ------- | ------- | ------- | 83.56 |
| Number of clear days | 19 | 19 | 15 | 17 | 5 | 12 | 14 | 20 | 14 | 8 | 14 | 13 | ------- | 170 |
| Number of partly cloudy days | 7 | 5 | 9 | 9 | 7 | 7 | 2 | 1 | 8 | 8 | 9 | 7 | ------- | 79 |
| Number of cloudy days | 5 | 7 | 6 | 5 | 18 | 12 | 15 | 8 | 9 | 14 | 8 | 10 | ------- | 117 |
| Average wind velocity in miles per hour | 3.99 | 3.79 | 3.50 | 4.04 | 5.19 | 3.73 | 5.09 | 4.41 | 4.01 | 5.51 | 5.43 | 4.30 | 4.42 | ------- |

## REPORT ON THE FINANCES OF THE STATION

The Station is a department of the University and its accounts are kept in the office of the Treasurer of the University. The books, voucher files, etc., are, however, all distinct from those of the other departments of the University. The classification of accounts is that prescribed by the auditors on the part of the Federal Government, and approved by the State Auditor. All of the accounts may be audited by the State Auditor, and the Hatch Fund, Adams Fund, Purnell Fund, and Bankhead-Jones Fund accounts are also audited by the Office of Experiment Stations acting for the Secretary of Agriculture of the United States in accordance with federal law.

The income of the Station from federal and state appropriations for the year that ended June 30, 1936, was:

| | |
|---|---|
| U. S. Government, Hatch Fund | $15,000.00 |
| U. S. Government, Adams Fund | 15,000.00 |
| U. S. Government, Purnell Fund | 60,000.00 |
| U. S. Government, Bankhead-Jones Fund | 5,173.04 |
| State of Maine, Mill Tax, Other Income, Sales, etc. | 41,419.67 |
| State Department of Agriculture | 14,940.12 |
| Total Income | $151,532.83 |

The cost of maintaining the laboratories for the inspection analyses is borne by analysis fees and by the State Department of Agriculture. The income from sales at the experimental farms and the poultry plant is used for the expense of investigations. The cost of printing the Station bulletins is paid by the University from funds other than those mentioned above.

At Aroostook Farm there are in connection with the coöperative work with the Federal Department of Agriculture certain expenditures for the Department made from sales of crops from Department investigations. These expenditures are not included in the tabular statements. They are carried as distinct and separate accounts, always with credit balances on the Station ledger.

# REPORT OF THE TREASURER FOR THE YEAR ENDING JUNE 30, 1936
## Disbursements

| | Federal Funds | | | | State Funds | | | Total |
|---|---|---|---|---|---|---|---|---|
| | Hatch | Adams | Purnell | Bankhead-Jones | Bankhead-Jones Offset | Mill Tax, Other Income, Sales, etc. | Inspections | |
| Personal Services | | | | | | | | |
| Salaries | $ 7,491.72 | $14,670.51 | $44,556.31 | $1,800.00 | $5,173.04 | $ 4,889.80 | $12,545.00 | $ 91,126.38 |
| Labor | 1,014.59 | —— | 6,258.41 | 510.68 | —— | 13,645.74 | 671.89 | 22,101.31 |
| Supplies and Materials | | | | | | | | |
| Stationery and office supplies | 354.23 | —— | 202.27 | 19.15 | —— | 296.00 | 31.62 | 903.27 |
| Scientific supplies, consumable | 142.80 | 23.11 | 898.81 | —— | —— | 632.79 | 496.58 | 2,194.09 |
| Feeding stuffs | 97.65 | 154.30 | 903.25 | —— | —— | 849.10 | —— | 2,004.30 |
| Fertilizers | 37.50 | —— | 1,409.08 | 60.00 | —— | 156.19 | —— | 1,662.77 |
| Sundry supplies | 389.11 | 8.37 | 415.76 | 67.27 | —— | 1,990.79 | 75.94 | 2,947.24 |
| Communication Service | 245.68 | —— | 37.65 | 166.75 | —— | 297.00 | 43.36 | 790.44 |
| Travel Expenses | 2,040.88 | —— | 1,217.16 | 102.04 | —— | 2,510.74 | 204.99 | 6,075.81 |
| Transportation of Things | 110.70 | 10.00 | 96.20 | —— | —— | 505.22 | 98.79 | 820.91 |
| Printing and Illustration Publications | 38.11 | —— | .85 | —— | —— | 50.07 | —— | 89.03 |
| Heat, Light, Water, and Power | 1,358.07 | 116.00 | 451.93 | 26.36 | —— | 3,245.57 | 428.96 | 5,626.89 |
| Contingent | 29.99 | —— | 101.48 | —— | —— | 237.95 | 20.00 | 389.42 |
| Equipment | | | | | | | | |
| Furniture, furnishings, and fixtures | 417.23 | —— | 538.85 | 35.49 | —— | 134.26 | 9.02 | 1,134.85 |
| Library | 443.37 | —— | 25.00 | —— | —— | 1,511.71 | 3.00 | 1,983.08 |
| Scientific equipment | 251.57 | 17.71 | 883.16 | 290.00 | —— | 285.66 | 229.78 | 1,957.88 |
| Tools, machinery, and appliances | 135.36 | —— | 1,734.78 | 553.43 | —— | 3,403.28 | 31.60 | 6,158.45 |
| Livestock | 79.50 | —— | 186.40 | 1,175.00 | —— | 117.40 | —— | 1,558.30 |
| Buildings and Land | 321.94 | —— | 82.65 | 66.87 | —— | 503.89 | 49.59 | 1,024.94 |
| Total | $15,000.00 | $15,000.00 | $60,000.00 | $5,173.04 | $5,173.04 | $35,263.16 | $14,940.12 | $150,549.36 |